Food and Agriculture Organization of the United Nations

EUROPEAN INLAND FISHERIES AND AQUACULTURE ADVISORY COMMISSION

EIFAAC/OP60 (En)

EIFAAC OCCASIONAL PAPER

ISSN 2221-6650

European inventory of fish damages caused by cormorant predation

eaa European Anglers Alliance

FEAP FEDERATION OF EUROPEAN AQUACULTURE PRODUCERS

European inventory of fish damages caused by cormorant predation

Food and Agriculture Organization of the United Nations

Rome, 2026

Required citation:
FAO. 2026. *European inventory of fish damages caused by cormorant predation.* EIFAAC Occasional paper No. 60. Rome. https://doi.org/10.4060/ce1056en

ISSN 2221-6650 [Print]
ISSN 2958-8480 [Online]

ISBN 978-92-5-140920-6

Abstract

This report presents the findings of a European inventory of damages and losses caused by cormorant predation to inland fisheries and aquaculture. It addresses persistent and increasing concerns across Europe regarding the economic impacts of growing and expanding cormorant populations and addresses gaps in data and information on predation-related damages. While local and national assessments exist, comprehensive and comparable information at the European level is limited, constraining evidence-based policy development.

The inventory was conducted through a joint survey by the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), the European Anglers Alliance (EAA) and the Federation of European Aquaculture Producers (FEAP). Information was received from stakeholders in 26 countries through structured questionnaires and standardized data entry sheets, covering the reference years 2023 and 2024. The methodology combined quantitative estimates of predation, based on bird abundance, duration of occurrence and consumption rates, with qualitative information on observed impacts. A standardized valuation approach was applied, including assumptions about daily fish consumption, average fish prices, and a corrective factor to account for indirect stress-related losses.

The results confirm that cormorant predation causes substantial and widespread economic impacts on fish populations across Europe. Damage occurs through direct consumption, injury and disturbance, leading to reduced growth, increased mortality and altered fish behaviour. Inland fisheries are affected through reduced catches, diminished stock productivity and increased reliance on costly stocking programmes. The economic impact of cormorant predation on inland fisheries is estimated at approximately EUR 150–220 million annually. Aquaculture is particularly affected in pond-based systems, where predation often results in production losses of 10–30 percent at the farm level. Reported damages to freshwater aquaculture exceed EUR 138 million annually in surveyed countries, with total European losses likely exceeding EUR 250 million per year.

In addition to direct losses, stakeholders incur significant costs for prevention and mitigation measures, including scaring, netting, guarding and restocking, which further reduce economic viability. Persistent predation pressure has contributed to farm closures, reduced production intensity, and declining profitability in several regions. Existing compensation schemes for cormorant-related damages are highly variable across countries and are insufficient to fully offset the economic losses incurred by fisheries and aquaculture operators.

The findings highlight the need for coordinated policy responses at the European level. Key recommendations include improving monitoring and data collection systems, enhancing the comparability of damage assessments, supporting effective and proportionate management measures, and implementing the Framework for a European Management Plan for the great cormorant, which balances conservation objectives with the sustainability of fisheries and aquaculture.

Contents

Abstract iii
Preparation of this document vii
Acknowledgements viii
Abbreviations x
1. Introduction 1
1.1 Background and rationale 1
1.2 Objectives of the European inventory 1
1.3 Institutional collaboration: EIFAAC, FEAP and EAA 2
1.4 Policy context and relevance 2
1.5 Scope, geographical coverage and reference years 4
1.6 Structure of the report 4
2. Methodology 5
2.1 Survey concept and approach 5
2.2 Survey tools 6
2.3 Survey participation and coverage 8
3. Cormorant occurrence and abundance 9
4. Freshwater aquaculture and inland fisheries in Europe 12
4.1 Freshwater aquaculture production 12
4.2 Freshwater capture fisheries production 14
4.3 Hatchery fish prices throughout Europe 15
5. Reported fish damage 17
5.1 Overview of damage types 17
5.2 Most affected fish species 17
5.3 Stocking to mitigate cormorant predation effects 18
5.4 Preventive measures taken to reduce predation 18
6. Economic impact assessment 20
6.1 Estimation of cormorant predation impact on aquaculture production in Europe 20
6.2 Aquaculture farm losses 21
6.3 Aquaculture farm closures attributed to cormorant predation 22
6.4 Estimation of cormorant predation impact on inland fisheries in Europe 22
6.5 Damage compensation schemes and their effectiveness 24
6.6 Food security implications of cormorant predation of fish in Europe. 25
6.7 Economic consequences of cormorant predation over time 26

7. Conclusions and recommendations 27
7.1 Main conclusions 27
7.2 Recommendations for policymakers 27
7.3 Needs for future monitoring, research and collaboration 28
References 29
Annex 1 Country Reports 33
Austria 33
Belgium 35
Croatia 37
Cyprus 40
Czechia 42
Denmark 45
Estonia 49
Finland 51
France 53
Germany 60
Greece 64
Hungary 66
Latvia 68
Lithuania 70
Republic of Moldova 73
The Kingdom of the Netherlands 75
Norway 79
Poland 80
Romania 84
Serbia 87
Slovakia 89
Spain 91
Sweden 94
Switzerland 98
Ukraine 101
United Kingdom of Great Britain and Northern Ireland 103
Annex 2 Survey questionnaire: angling organizations 105
Annex 3 Predator damage data entry sheet: aquaculture and fisheries 106
Annex 4 Tables 108
Annex 5 Damage caused by cormorants in Poland 108

Preparation of this document

This paper was prepared in 2025–2026 by Raymon van Anrooy, Secretary of the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), with database assistance from Rodrigo Alvarado Bendana of FAO's Fisheries and Aquaculture Division and technical assistance from Ian G. Cowx of the University of Hull, the United Kingdom of Great Britain and Northern Ireland. The preparation of this technical paper was funded by FAO's regular programme allocation for EIFAAC.

The need to prepare an inventory of economic damages caused by cormorant predation arose from the stakeholder consultation process for the Framework for a European Management Plan for the great cormorant. During stakeholder consultations, representatives of many fish farmer and angling organizations shared qualitative and sometimes quantitative information on the damage caused by cormorants to their activities. However, most information on the economic impact of cormorant predation is not publicly available, while numerous studies have been published on its ecological impact. The focus on ecological and conservation research over the past decades, coupled with the limited availability of economic data and information, has likely contributed to the limited attention policymakers have paid to the cormorant-fish conflict.

The European Anglers Alliance (EAA) and the Federation of European Aquaculture Producers (FEAP) expressed a similar need to fill the gap in data and information on the economic impact of cormorant predation on fish across Europe and supported this inventory study. Mark Owen and Jan Kappel (EAA), along with Szilvia Mihalffy and Béla Halasi-Kovács (FEAP), actively contributed to the design of the survey method and the dissemination of the survey among the membership of their organizations.

During the implementation of the survey, it became evident that most farmers and fishers affected by predation do not consistently document the damages and losses caused by predation. Consequently, the data and information collected showed considerable variation, with high-quality datasets covering detailed production data per fish pond, including losses caused by predation by species for several years, while other farmers and fishers provided guesstimates of their losses. Similarly, some angling clubs carefully documented stocking costs, cormorant days and losses of fish, while others presented only anecdotal evidence. In countries with established damage compensation schemes, there was greater interest to document expenditures on preventive measures, restocking and evidence of damage, which facilitated the inventory. Because the research is the first of its kind in Europe, the piloted methods used for data collection and analysis will need development to facilitate future reporting and monitoring of economic damages caused by cormorants and other predators to fisheries and aquaculture.

The participation of 26 countries in this inventory study demonstrates a regionwide commitment to addressing the cormorant-fish conflict, not just from a conservation perspective but also from the perspective of the economic impact of fish predation. The data and information received for this inventory can assist policy decision-making processes at the European and national levels and can also contribute to the evidence base needed for implementing the Framework for a European Management Plan for the great cormorant.

The inventory findings were presented at the ProtectFish General Assembly meeting in Vienna, Austria, in April 2026, and reviewed by EAA and FEAP before publication.

This document was edited by Maria Giannini and layout assistance was provided by Chorouk Benkabbour (FAO).

Acknowledgements

The authors would like to acknowledge the support received from the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), the European Anglers Alliance (EAA) and the Federation of European Aquaculture Producers (FEAP) members who completed the survey in 2025, and the many fish farmers, anglers and commercial fishers who shared data and information regarding cormorant impacts on their activities. Access to FAO data on aquaculture pond areas was kindly provided by Xiaowei Zhou of FAO's Fisheries and Aquaculture Division. The authors would like to express their appreciation to the following people and organizations for having assisted with compiling and reviewing the available data and information from their respective countries.

Austria: Christian Bauer (Federal Office for Water Management).

Belgium: Veerle Campens (Flanders Agency for Agriculture and Fisheries), Bertrand Hoc (Collège de producteurs), and members of the Fédérations Halieutiques et Piscicoles agréées de sous-bassin of Wallonie.

Croatia: Ana Gavrilovic (University of Zagreb).

Cyprus: Constantinos Moustakas (Department of Fisheries and Marine Research).

Czechia: Jakub Mořický and Alžběta Strouhová (Ministry of Agriculture of the Czech Republic), and representatives of the Czech Fish Farmers Association and the Czech Anglers Union.

Denmark: Kaare Manniche Ebert (Danmarks Sportsfiskerforbund), Niels Jepsen and Mathis Olesen (Danish Technical University), Lene Jensen Scheel-Bech (Danish Ministry of Food, Agriculture and Fisheries), and the Danish Aquaculture Producer Organization.

Estonia: Signe Soomann (Ministry of Regional Affairs and Agriculture of the Republic of Estonia).

Finland: Petri Heinimaa (Natural Resources Institute Finland).

France: Anne Oswald (Ministry of Ecological Transition, Biodiversity, Forestry, Sea and Fisheries), 16 Departmental Federations for fisheries and the protection of the aquatic environment (FD 7, 11, 16, 17, 28, 31, 32, 47, 48, 53, 55, 60, 73, 74, 79 and 86), and the French aquaculture sector, including Sandrine Rambert of Fédération Française d'Aquaculture and Alain Marié of Étangs de France.

Germany: Florian Stein of the German Angling Association (Deutscher Angelfischerverband e.V.) and its member angling clubs, fish farmer members of the Association of German Inland Fisheries and Aquaculture (Verband der Deutschen Binnenfischerei und Aquakultur e.V.), Reinhold Hanel (Thünen Institute), Robert Arlinghaus (Leibniz-Institute of Freshwater Ecology and Inland Fisheries), and Jasminca Behrmann-Godel (Ministry of Food, Rural Affairs and Consumer Protection of Baden-Württemberg).

Greece: Alkisti Batzina and Georgia Papaioannou (Ministry of Rural Development and Food).

Hungary: Béla Halasi-Kovács (SCIAP consulting), Lívia Diána Balatoni-Marsi of the Hungarian National Fishing Association (Magyar Országos Horgász Szövetség), who compiled data from its member angling clubs, and pond fish farmers of the Hungarian Association of Fish Producers and Fishing Water Users (MA-HAL).

Latvia: Ruta Medne (Institute of Food Safety, Animal Health and Environment).

Lithuania: Loreta Bražinskaitė (Ministry of Agriculture of Lithuania) and Antanas Kontautas (Recreational Fishery Council).

Republic of Moldova: Sergiu Balacci (Ministry of Environment).

Kingdom of the Netherlands: Robbert-Jan Schaap (Ministry of Agriculture, Fisheries, Food Security and Nature) and Jan Kamman (Sportvisunie), who compiled data and information of the many member angling clubs.

Norway: Helge Axel Dyrendal (Norwegian Environment Agency).

Poland: Igor Wawrzyniak (National Marine Fisheries Research Institute), Andrzej Kapusta and Piotr Traczuk (National Inland Fisheries Research Institute in Olsztyn), Anna Pyć (Polish Trout Breeders Association), and Jakub Roszuk (Advisory Group for Inland Fisheries, Aquaculture and Angling to the Minister of Agriculture and Rural Development).

Romania: Catalin Platon (Romanian National Fish Producers Association – Romfish) and the General Association of Hunters and Anglers from Romania (AGVPS).

Serbia: Dušan Ognjanović (Ministry of Environmental Protection) and Mirko Novakovic (Ministry of Agriculture, Forestry and Water Management).

Slovakia: Dominik Škoda (Ministry of Agriculture and Rural Development) and the Slovak Anglers Association.

Spain: Julián García Baena and María Luz Arregui Maraver (Ministry of Agriculture, Fisheries and Food) and FEAP members in Spain.

Sweden: Elin Gunve (Swedish Board of Agriculture), the Swedish Agency for Marine and Water Management, and the Swedish Environmental Protection Agency.

Switzerland: Oliver Selz (Swiss Federal Office for the Environment – BAFU) and Schweizerischer Fischerei-Verband.

Türkiye: Serhat Dinçer (Ministry of Agriculture and Forestry).

Ukraine: Mykola Fedorenko and Kostiantyn Demianenko (State Institution Methodological and Technological Center for Aquaculture of the State Agency for the Development of Melioration, Fisheries, and Food Programs of Ukraine under the Ministry of Economy, Environment and Agriculture).

United Kingdom: Mark Owen (The Angling Trust), Ian G. Cowx (University of Hull), and Iain Berrill (Salmon Scotland).

Abbreviations

ASFIS	Aquatic Sciences and Fisheries Information System
CHF	Swiss franc
DKK	Danish krone
DTU	Danish Technical University
EAA	European Anglers Alliance
EC	European Commission
EEA	European Environment Agency
EIFAAC	European Inland Fisheries and Aquaculture Advisory Commission
EIFAC	European Inland Fisheries Advisory Commission (until 2010)
EU	European Union
EU-27	27 Member States of the European Union
EUR	euro
Excel	Microsoft Excel
FAO	Food and Agriculture Organization of the United Nations
FEAP	Federation of European Aquaculture Producers
FishStatJ	FAO software for fishery and aquaculture statistical time series
ha	hectare
JNCC	Joint Nature Conservation Committee
kg	kilogram
km	kilometre
m^3	cubic metre
NEI	not elsewhere included
PLN	Polish zloty
RAS	Recirculating aquaculture system
Romfish	Romanian National Fish Producers Association
UNEP	United Nations Environment Programme
USD	United States dollar

1. Introduction

1.1 Background and rationale

Throughout Europe, there is growing concern about the effects of predation by great cormorants, particularly *Phalacrocorax carbo sinensis*, on fish and fisheries in European rivers, lakes, coastal waters and aquaculture facilities.

Since the adoption of the Birds Directive (79/409/EEC) in 1979, the residual population of great cormorants in Europe has grown to more than two million birds. This conservation success has led to an increase in conflicts between fishing and aquaculture interests and cormorant protection advocates. These conflicts are widespread across Europe and stem from cormorant predation of fish in rivers, lakes, coastal areas and aquaculture ponds. The number of conflicts has increased since the mid-1990s, but very few have been resolved (FAO, 2024a).

Scientific findings have confirmed the observations of commercial fishers, recreational anglers and aquaculturists that an excessive number of cormorants can significantly impact fish and fisheries. Published scientific evidence from peer-reviewed journals indicates that the current levels of cormorant predation of fish are negatively impacting aquatic biodiversity.

River-dwelling fish are among the most threatened animal groups worldwide (Sayer *et al*., 2025). In Europe, the populations of several species of fish protected by the Habitats Directive (92/43/EEC) are decreasing rapidly. One such protected species that has experienced drastic decline, and where countless unique populations (river specific) have been lost, is the grayling (*Thymallus thymallus*). Overwhelming evidence indicates that the direct and only cause for the decline is predation by cormorants. Studies have also found significant negative impacts on the populations of brown trout (*Salmo trutta*), Atlantic salmon (*Salmo salar*) and eel (*Anguilla anguilla*).

Cormorant predation has also negatively affected the economic viability of many European commercial and recreational fisheries enterprises and aquaculture farms. Many of these businesses have had to stop their income-earning activities because regulations prohibit practical methods to reduce cormorant predation and they could not bear the costs of restocking their ponds to compensate for production losses caused by predation.

The high abundance of highly migratory cormorants is problematic and has already proven to be catastrophic for various stocks of protected fish species. Cormorant predation also cancels out the positive effects of river restoration, fish stock management and conservation efforts by the inland fisheries and aquaculture sectors.

The migratory aspects of both the cormorants and the river-dwelling fish they prey upon indicate that the cormorant problem cannot be solved at the national level alone. Therefore, concerted action covering the cormorants' entire distribution range is necessary (EIFAAC, 2022).

1.2 Objectives of the European inventory

The objectives of the European inventory of damages and losses caused by cormorants and other predators to fish, fisheries and aquaculture, were to:

(i) inform European Union and national policymakers of the economic impact cormorant predation has on inland fisheries and aquaculture;

(ii) advise the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), the Federation of European Aquaculture Producers (FEAP) and the European Anglers Alliance (EAA) membership of the various damage compensation systems used throughout Europe;
(iii) contribute to the development of the Framework for a European Management Plan for the great cormorant; and
(iv) make the public aware of the consequences of large-scale predation of fish on their food security, aquatic biodiversity, business environment and rural incomes.

1.3 Institutional collaboration: EIFAAC, FEAP and EAA

Members of EIFAAC, FEAP and EAA frequently raise concerns about the damages and fish losses caused by bird predation. They have observed an increasing trend of damage to fish stocked in inland waters and to freshwater pond aquaculture production, particularly from predation by cormorants. At almost every recent meeting of these organizations, members have discussed the damages and losses caused by bird predation and have requested that the secretariats inform policymakers and decision-makers at the European Union and national levels about the predation problems they encounter.

The three organizations have a history of collaborating on fisheries and aquaculture. Together, they have jointly worked on European regional aquaculture sector reviews (e.g. Hough, 2022), promoted best aquaculture practices, supported the development of the EIFAC Code of Practice on Recreational Fisheries (FAO/EIFAC, 2008), and established the methodologies for assessing the socioeconomic benefits of inland recreational fisheries (Parkkila *et al.,* 2010).

By joining forces for this inventory study, these organizations aimed to collect data and information on bird predation of fish from a larger number of commercial and recreational fisher organizations, aquaculture farmers and their associations, fisheries and aquaculture management and research organizations throughout Europe.

1.4 Policy context and relevance

A range of international and regional instruments, European Union (EU) directives and policies, and national legislation affect the management and conservation of the great cormorant. Key international instruments include the 1979 Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the 1995 Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA). The following conventions and directives currently affect the management and conservation of cormorants within the European Union:

- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1979).
- EU Directive on the Conservation of Wild Birds (Birds Directive, 2009).
- EU Directive on the conservation of natural habitats and of wild fauna and flora (Habitats Directive, 1992).
- EU framework for community action in the field of water policy (Water Framework Directive, 2000).
- EU Regulation 2024/1991 of the European Parliament and of the Council of 24 June 2024 on Nature Restoration and Amending Regulation (EU) 2022/869 (Nature Restoration Regulation, 2024).

The Birds Directive of 2009 is the main European legislation protecting the great cormorant. For an overview of how various conventions and directives relate to cormorant, fish, fisheries and aquaculture conflicts, consult the Framework for a European Management Plan for the great cormorant (FAO, 2026). The framework also describes the cormorant's impact on the implementation and outcomes of various other elements of European Union policies and legal frameworks.

Over the past several decades, the number of great cormorants breeding and wintering in Europe has increased dramatically, creating conflicts between bird conservation and fisheries and aquaculture. The increase was already recognized by the European Union Committee of the Regions in 1997 in its opinion on "The immediate measures which need to be taken to counter the damage caused by cormorants in the European regions" (97/C215/09). In particular, the opinion stated: "The ecological balance has been jeopardized. The cormorant population in 1979 was approximately 30 000 but by 1995 it was estimated at 700 000" (European Commission, 1997).

In many European countries, the large populations of great cormorants negatively impact fish stocks and reduce catches, putting pressure on fisheries and aquaculture activities and generating socioeconomic conflicts. Since the 1980s, the increasing negative impacts of cormorant predation on inland fish stocks, biodiversity and fish production in aquaculture have been recognized by EIFAAC (FAO, 1988) and the European Parliament in various resolutions, including:

- European Parliament resolution of 4 December 2008 on the adoption of a European Cormorant Management Plan [aimed] to minimize the increasing impact of cormorants on fish stocks, fishing and aquaculture (2008/2177(INI)).
- The European Parliament resolution of 12 June 2018 towards a sustainable and competitive European aquaculture sector: current status and future challenges (2017/2118(INI)).
- European Parliament resolution of 4 October 2022 on striving for a sustainable and competitive EU aquaculture: the way forward (2021/2189(INI)).

Members of the European Parliament have also expressed concerns about the impact of cormorants on fish stocks, fisheries and aquaculture. They have called for European-wide management of cormorants in European Parliament Committee on Fisheries (PECH) meetings and in written questions to the European Commission, such as:

- Question and Answer session at the PECH ordinary meeting of 17 March 2026 on the Framework for a European Management Plan for the great cormorant (https://www.fao.org/eifaac/news/news-detail/european-parliament-discusses-a-coordinated-approach-to-cormorant-management/en).
- Question for written answer E-000372/2026 to the Commission of 19 January 2026. Subject: Need for concrete actions following structured dialogue on the management of the Great Cormorant (https://www.europarl.europa.eu/doceo/document/E-10-2026-000372_EN.html).
- Question for written answer E-001478/2026 to the Commission of 10 April 2026. Subject: EU support for the Cormorant Management Advisory Group (https://www.europarl.europa.eu/doceo/document/E-10-2026-001478_EN.html).

Additionally, a recent EIFAAC survey (FAO, 2024a), which included responses from 26 European countries, revealed a high level of conflict between cormorants and biodiversity conservation, recreational and commercial fisheries, and aquaculture. These conflicts have either continued or increased in severity. Similar trends have also been reported by EAA (2026), Kohl (2010) and FEAP (2024).

EIFAAC's Resolution (EIFAAC/31/2022/3), "On Measures to Support the Protection of Vulnerable and Endangered Fish Species from Unsustainable Predation from Cormorants," calls for collaboration with recreational fisheries associations and commercial fisheries organizations to assess the available

research and analysis on cormorant predation and report local impacts of such predation to the EIFAAC project, "Developing Advice on Sustainable Management Actions on Cormorant Populations" (EIFAAC, 2022).

This regional inventory of damages and losses caused by cormorants and other predators to fish, fisheries and aquaculture contributes to implementing the above resolution and the Framework for a European Management Plan for the great cormorant. The inventory also helps fill part of the large gap in essential data and information regarding the economic impact of the cormorant population growth on fisheries and aquaculture in Europe.

1.5 Scope, geographical coverage and reference years

This inventory study focused on assessing the economic damages and losses caused by cormorant predation of fish in inland and coastal waters, as well as in aquaculture. The geographical coverage of the study was Europe. All 38 member states of EIFAAC,[1] 11 member associations of EAA and 27 members of FEAP were invited to contribute data and information. The target reference years for data collection were 2023 and 2024. Government agencies and stakeholder organizations that did not have data from these years were asked to share any data they had collected. The data entry sheets and forms used for information collection are presented in Annex 2 and Annex 3.

1.6 Structure of the report

This report is structured as follows. Chapter 2 describes the methodology and survey approach used for the inventory. Chapter 3 presents an overview of cormorant occurrence and abundance based on the collected data. Chapter 4 provides background information on freshwater aquaculture and inland fisheries production in Europe, including production volumes, values and price structures relevant to the assessment. Chapter 5 analyses the reported damages to fish caused by cormorant predation, such as the impacts on fish stocks, species affected and mitigation measures applied. Chapter 6 presents an economic impact assessment, which includes the estimated damage to aquaculture and inland fisheries, as well as the associated costs and losses. Chapter 7 presents the main conclusions and policy-relevant recommendations derived from the analysis. The annexes provide supporting information, including country summaries, survey tools and additional methodological details.

[1] For the list of EIFAAC members, see https://www.fao.org/eifaac/about/membership/en.

2. Methodology

2.1 Survey concept and approach

In January 2025, EIFAAC, EAA and FEAP developed a joint survey to gain greater insight into the damages and losses caused by cormorants and other predators to fish in aquaculture ponds and waterbodies used for inland recreational and commercial fisheries.

Given the variety of stakeholders involved in the survey, it was decided to design a questionnaire for recreational fisheries and angling associations, and an Excel-based data collection tool with dedicated data entry sheets for aquaculture farmers/associations and government agencies. This approach was considered the most effective method for collecting both qualitative and quantitative information.

The survey cover letter for the joint EIFAAC/EAA/FEAP European inventory was amended by each participating organization before distribution to encourage responses from their member communities. The cover letters, signed by the chairpersons of the respective organizations, were sent to the national-level focal points, such as national federations of angling associations and aquaculture farmers associations, in each member country.

The survey consisted of two parts: (i) a questionnaire for recreational fisheries and angling organizations, which was also made available in French and German; and (ii) Excel-based predator damage data entry sheets for aquaculture and fisheries organizations for the years 2023 and 2024; additional entry sheets were included for recording information on losses and closed enterprises resulting from excessive cormorant predation of fish. The questionnaire and Excel data entry sheets formats can be found in Annex 2 and Annex 3.

The national focal points were asked to help disseminate the survey to their members and facilitate the collection of data and information at the national level. The EIFAAC operational focal points, national fisheries and aquaculture administrations, national federations of anglers and sport-fishing associations, and national aquaculture organizations helped distribute the survey forms and data entry sheets to hundreds of stakeholders in over 30 European countries.

The survey was disseminated in February and March 2025. The initial data collection period was from February to April 2025; however, some respondents requested more time and were allowed to submit their data until the end of May. Data were submitted either directly to the EIFAAC Secretariat via email or compiled by national federations and then submitted to EIFAAC.

Data and information were submitted in Dutch, English, French, German, Hungarian, Polish, Spanish, and other languages. In May and June 2025, the EIFAAC Secretariat translated this information using online tools and partly entered the information into an Excel-based database. Additional information, such as assessment and damage reports, scientific studies and qualitative information received by email, was stored for analysis.

The EIFAAC Secretariat carried out data validation, asking respondents to clarify or provide additional information when there were specific gaps or inconsistencies. In March and April 2026, draft national summaries were shared with operational focal points and key contributors of data and information for their comments and to address data gaps.

At the end of April 2026, a draft regional inventory was presented in Vienna, Austria at the General Assembly meeting of the ProtectFish project, a European Union’s Horizon Europe Research and Innovation Programme funded project. Comments and validation by the scientists were welcomed.

2.2 Survey tools

The survey used two main tools: (i) a Microsoft Word-based questionnaire for recreational fisheries and angling organizations; and (ii) Excel-based predator damage data entry sheets for national fisheries and aquaculture administrations and aquaculture and fisheries organizations.

The survey for recreational fisheries organizations used a structured questionnaire and was distributed to national angling organizations, which had the option of involving regional and local clubs. Respondents were asked to provide data on the presence and impacts of predators for 2023 and 2024, focusing primarily on cormorants. The questionnaire collected information on the number of birds (including breeding pairs and estimated bird-days), seasonal occurrence, and the relative contribution of different predators. It also gathered data on affected fish species at the national and local levels, as well as estimates of economic damage, including costs related to restocking, bird deterrence, monitoring, and losses in membership and revenue. Respondents were encouraged to support their answers with available studies or expert judgement and to report both quantitative data and qualitative observations where precise data were unavailable. The survey was distributed to all EAA members. Some of these members shared the survey with their member angling clubs, while others organized their own surveys to support the inventory. The questionnaire's format can be found in Annex 2.

The second part of the survey consisted of structured, Excel-based data entry sheets designed to collect harmonized data on damage caused by fish-eating predators, with a primary focus on cormorants. The tool comprised four data entry sheets and a dedicated notes sheet, which provided methodological guidance. It was distributed to the EIFAAC Operational Focal Points and FEAP members, who then requested their contacts to assist with completing the sheets.

Two annual sheets (2023 and 2024) collected quantitative data on predator presence and impacts. Respondents were asked to report the number of individuals (including breeding and non-breeding populations), duration of occurrence (days per year), estimated economic damage (in EUR), compensation received (in EUR), and management actions (including permits issued and the number of birds culled). Standardized parameters, such as daily fish consumption, prices and corrective stress factors, were provided to support consistent estimation of damage. Additional fields allowed for reporting on other predators, such as herons and otters, and related costs (see Annex 3).

Fish consumption by cormorants

Information from scientific studies was used to estimate the daily fish consumption of cormorants. The average daily food intake of wintering great cormorants is estimated at 0.5 kg/day. However, some studies suggest that it could be as high as 0.62 kg/day or 0.8 kg/day. Breeding birds have an average daily food intake of 0.8 kg/day, according to some studies, while chicks have an intake of more than 0.3 kg/day (Grémillet *et al*., 2003; Keller and Visser, 1999; Ridgway, 2010; Dehnhard *et al*., 2021). Therefore, a conservative estimate of the mean daily food intake by cormorants is 500 g/day, which is applied in this inventory.

Fish prices

This study applied an average fish price of EUR 4/kg, unless detailed national average fish prices by species were available. The price of fish per kilogram varies considerably by species, stage in the life cycle and country. Off-farm prices from aquaculture farms and landing site prices from fisheries are the most suitable for assessing the value of fish per kilogram in Europe. FAO annually collects off-farm fish prices (see Chapter 6, section 6.1) and has price data from various landing sites. In general, there are price linkages between capture fisheries and aquaculture for species supplied by both sectors. Asche, Roll and Tveterås (2025) have demonstrated evidence of market integration and substitution. Aquaculture expansion increases the supply and places downward pressure on the prices of capture

fisheries, thus confirming direct competition for the same species. However, the degree of competition varies by market structure, product form (for example, live carp fetches a higher price in Eastern European countries) and quality differentiation. Farmed and wild products are increasingly part of a single, interconnected market system, and thus have similar market prices.

Stress factor

Predation risk from birds, such as cormorants and herons, and mammals, such as otters, induces strong anti-predator responses in fish, including inactivity, refuge use, and reduced foraging. These responses can suppress feeding, thereby reducing growth and biomass production, although such effects are rarely quantified directly. Various scientific studies have shown significant effects of predators on fish stress, feeding behaviour, fish biomass growth and fish health (Kortan *et al*., 2010; Kortan and Adamek, 2011; Kortan, Adámek and Flajšhans, 2008; Klenke *et al*., 2013; Ovegård *et al*., 2021; Petersson and Järvi, 2006). Experimental studies show that predation risk can reduce feeding rates in fish by approximately 20–60 percent, with typical values around 30–40 percent (Lima and Dill, 1990; Sunardi, Manatunge and Fujino, 2007). Nevertheless, there is still little scientific evidence tying cormorant presence to fish biomass through non-consumptive stress pathways because such studies are largely lacking. It is clear, however, that predator-induced stress produces measurable physiological and behavioural changes in fish, including reduced feeding, growth and increased energetic costs, but these responses are context-dependent and cannot be easily generalized into fixed, quantitative growth effects (Sopinka *et al*., 2017; Iwama, Afonso and Vijayan, 2006; Lima and Dill, 1990).

Fish farmers often reported side effects of fish predation by cormorants, such as hiding behaviour, injured fish, reduced feed intake and slower fish growth. Experiments to reduce the predation impact in aquaculture pond systems and angling club waters with artificial refuges have shown positive results in reducing fish stress (Lemmens *et al*., 2016; Russell *et al*., 2008), also demonstrating that stress impacts fish behaviour and biomass.

To account for predation-related fish stress and its consequences for fish growth, a corrective (stress) factor has been applied in addition to the average price of fish. A stress factor (stressor) in fish is any environmental or internal factor that disrupts normal physiological and behavioural processes. This requires the organism to expend energy to maintain balance, often resulting in reduced feeding, growth and health (Barton, 1991; Schreck, Contreras-Sánchez and Fitzpatrick, 2001; Schreck, 2010; Kortan *et al*., 2010). Based on research conducted in Czechia, a stress factor of 25 percent was applied to better reflect the effects of cormorant predation on the fish harvest and, consequently, the damage caused by predation to the output of aquaculture and inland capture fisheries (Ministry of Agriculture of the Czech Republic, 2023). Given the absence of other examples and in view of the general agreement for this approach by survey respondents, the stress factor was applied European-wide.

Damage defined

In this inventory, damage is defined from an economic perspective as the quantifiable monetary loss of assets, production and income resulting from cormorant predation. Economic damage comprises both direct and indirect components. Direct damage refers to the immediate and measurable loss of fish biomass through consumption or injury of fish, corresponding to the loss of physical production assets. Indirect damage (or losses) refers to subsequent reductions in economic performance resulting from predation pressure, such as reduced growth, lower production yields, lost revenues, increased production costs, and impacts on the economic viability of fisheries and aquaculture operations. This distinction aligns with established economic frameworks, where direct losses represent the value of destroyed assets or production, and indirect losses reflect declines in output or income arising from these initial impacts (see also UNDRR, 2017).

Bird predation damage estimation formulae

The predation damage caused by cormorants and other predators could be calculated by a bioenergetic consumption model using the formulas embedded in the Excel data entry sheets.

The daily predation damage per bird can be expressed by the following formula:

$$\mathbf{D = C \times P \times S\ (1 + \alpha)}$$

Where:

D = daily predation damage per bird (EUR/day)

C = daily fish consumption per bird (kg/day)

P = average price of fish (EUR/kg)

S = stress factor

α = proportional stress-related loss (e.g. 0.25 = 25 percent)

Applying the values presented above, this would result for cormorants in:

D = 0.5 × 4 × 1.25 = 2.5 EUR/day per bird

Direct damage is represented by C × P

Indirect damage (stress effects) = S = 1 + α

The second formula used in the Excel data entry sheets is the following:

$$\mathbf{T = N \times O \times D}$$

N = number of individuals (i.e. cormorants)

O = number of days per year with occurrence (days/year)

D = daily damage per individual (EUR/day) (from the first formula above)

T = total annual predation damage (EUR/year)

Example: If there are, on average, 1 000 cormorants in a country for some 200 days per year (on average), the estimated total annual predation damage would be EUR 500 000.

T = 1 000 × 200 × 2.5 = 500 000 EUR/year

Historical information

In addition to the damage reporting and estimating sheets for 2023 and 2024, a historical aquaculture sheet was included in the Excel file to obtain information on farms affected by predation, including closures (location, year, pond area, species, production and income) and impacts on active farms (production levels, percentage of fish killed or damaged, and associated income losses). A corresponding fisheries sheet collected data on affected waterbodies, including their surface area, stocking investments, harvest levels, income and estimated losses.

A notes sheet provided detailed instructions on definitions, valuation methods (e.g. farmed vs stocked fish), consumption rates, corrective factors, and the reporting of additional costs, thereby ensuring comparability and transparency of responses across countries (see Annex 3).

2.3 Survey participation and coverage

Stakeholders from the following 26 countries submitted data and information to the EIFAAC Secretariat in response to the survey: Austria, Belgium, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, the Kingdom of the Netherlands, Latvia, Lithuania, Norway, Poland, the Republic of Moldova, Romania, Serbia, Slovakia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom of Great Britain and Northern Ireland.

Some other EIFAAC members, including Bosnia and Herzegovina, Israel and Slovenia, informed the secretariat that they recognized the survey's importance but did not have information to contribute. Türkiye informed the secretariat that the overall impact of cormorant predation on fish stocks and fish farming in Türkiye is relatively low because hunting of the species is permitted. Eastern European countries outside of the European Union, such as the Republic of Moldova, Serbia and Türkiye, where cormorants are not protected and are actively managed and hunted, often experience fewer problems with cormorant predation.

The country summaries in Annex 1 were compiled from input received from more than 300 entities, including national ministries and public authorities (approximately 18–20 countries); over 250 recreational fisheries and angling organizations (15–17 countries); more than 100 aquaculture producer organizations (14–16 countries); and individual fish farmers or farm-level datasets (10–12 countries). In many cases, multiple stakeholder groups contributed to a single country report.

The represented sectors included inland and coastal recreational and commercial fisheries, as well as inland and coastal aquaculture. Also represented were environmental, water and fisheries research institutions, along with ministries responsible for agriculture, fisheries, aquaculture, and the environment. Most respondents represented angling and recreational fisheries organizations, as well as fish farmer organizations, that want to maintain and improve fish biodiversity and healthy stocks in inland waters and on their members' farms.

The responses received demonstrated regional coverage, with contributions coming from Greece and Ukraine in southeastern Europe, Spain and the United Kingdom in western Europe, and Finland, Norway, and Sweden in northern Europe.

3. Cormorant occurrence and abundance

Table 1 provides quantitative data compiled for 26 countries out of 39 EIFAAC members (66 percent). Data received from these countries, which range from 2012 to 2025 (depending on the country), indicate approximately 825 000 breeding cormorants and 843 000 non-breeding cormorants. However, these data are incomplete, as some countries reported only on specific regions, and several countries that are hotspots for breeding, non-breeding or wintering cormorants are not included. Compared to the cormorant breeding and wintering population estimated by BirdLife International (2021) for 2013–2018, there are significant increases, particularly in the wintering population in the Baltic Sea riparian states.

Among the countries that participated in the inventory, the largest breeding populations of the great cormorant are concentrated in northern and eastern Europe. Sweden accounts for 150 000 breeding birds (18 percent), followed by Ukraine (140 000; 17 percent), Estonia (84 000; 10 percent), Denmark (61 000; 7 percent), and Poland (58 000; 7 percent). Together, these countries represent approximately 59 percent of the total breeding population counted in the 26 countries.

Some countries reported non-breeding cormorants (immature or young birds, failed breeders, old adult birds, and adults outside of the breeding season). Other countries, particularly those in southern Europe, reported wintering birds, which are birds present in their country during the winter. Wintering birds can include local resident breeders, migratory birds from other breeding populations in different countries, and immature or non-breeding birds. Consequently, the figures for non-breeding and wintering populations may get mixed up.

Wintering populations are more widely distributed, with major concentrations in western and southern Europe. Sweden reports the highest number of cormorants (149 534; 18 percent), followed by France (118 000; 14 percent), Romania (78 000; 9 percent), Spain (75 000; 9 percent), and the United Kingdom

(45 000; 5 percent), accounting for about 55 percent of all wintering and non-breeding cormorants reported by the 26 countries.

Economic damage is highly concentrated. Denmark reported the highest annual damage (EUR 91.8 million; 13.7 percent of total), followed by Sweden (EUR 80.7 million; 12.0 percent), Norway (EUR 46.4 million; 6.9 percent), Romania (EUR 44.7 million; 6.7 percent) and Estonia (EUR 44.2 million; 6.6 percent). These five countries account for approximately 46 percent of the total estimated damage of EUR 671.9 million caused by cormorant predation on fish in the 26 countries that provided data.

Overall, the results indicate a strong geographical concentration of both populations and impacts. Northern Europe hosts the largest breeding colonies, while wintering aggregations and associated economic impacts extend across the western, southern and eastern regions of Europe.

Table 1. Regional overview of average damage by cormorant populations to fish populations

Country	Breeding cormorant population (individuals)	Non-breeding population (individuals)	Estimated damages caused (EUR, average annual)	Reference years	Notes/basis
Austria	3 036	3 997	3 362 700	2023–2024	Available data from Upper Austria/Styria plus Lake Constance; subnational totals aggregated.
Belgium	0	427	388 000	2023–2024	Wallonia fish farms; breeding population not reported.
Croatia	3 300	20 000	8 985 000	2013–2018	National estimate based on European Environment Agency/Birds Directive reporting and consumption assumptions; reliability noted as low in summary.
Cyprus	750	5 125	2 718 000	2023–2024	Six fish farms; breeding and non-breeding damage combined.
Czechia	1 028	14 898	6 745 700	2023–2024	Czech Fish Farmers Association and Czech Anglers Union data; 2023 and 2024 averaged.
Denmark	61 470	39 000	91 796 000	2023–2025	Breeding/non-breeding and damage estimates averaged across available 2023–2025 data.
Estonia	84 150	Unknown	44 178 500	2023–2024	National breeding estimate; non-breeding not reported.
Finland	59 870	29 935	40 412 250	2023–2024	Breeding and non-breeding damage combined.
France	22 269	117 533	34 796 000	2021/2024	2023 estimate uses 2021 counts; 2024 uses 2024 breeding and wintering counts.
Germany	46 747	36 179	25 670 500	2023–2024	Breeding and wintering damage combined.
Greece	20 000	41 750	29 950 000	2023–024	Breeding and non-breeding damage combined.
Hungary	1 730	8 881	7 012 500	2023–2024	Breeding and non-breeding damage combined.
Latvia	5 740	Unknown	2 550 000	2023–2024	Breeding population only; non-breeding unknown.
Lithuania	16 700	Unknown	6 985 000	2023-2024	Breeding population only; non-breeding unknown.
Republic of Moldova	12 000	20 000	12 800 000	2023–2024	Breeding and non-breeding damage combined.
Netherlands (Kingdom of the)	37 000	41 000	28 470 000	2023–2024	2024 wintering range converted to midpoint for averaging.
Norway	43 400	28 379	46 440 000	2015/2020	Adult breeding and 1-/2-year old bird estimates; *Phalacrocorax carbo* and *P. c. sinensis* components combined.
Poland	58 166	39 003	42 520 000	2023–2024	National estimate; sedentary and flyover non-breeding components combined.
Romania	28 500	77 778	44 720 000	2023–2024	Breeding and non-breeding damage combined.
Serbia	1 980	14 000	8 107 000	2023–2024	Non-breeding range converted to midpoint.
Slovakia	0	11 500	4 313 000	2023–2024	Average non-breeding damage.
Spain	1 500	75 000	35 119 000	2023–2024	Breeding and non-breeding damage combined.
Sweden	149 534	149 534	80 748 000	2023	Breeding and non-breeding estimates from 2023 summary table.
Switzerland	7 311	11 922	0	2023–2024	Damage reported as zero in summary table; 2024 non-breeding not available, so 2023 retained.
Ukraine	140 000	12 500	22 125 000	Latest available	Single-year estimate from summary table.
United Kingdom of Great Britain and Northern Ireland	19 000	45 000	40 962 000	Latest available	Single-year estimate from summary table.
Total of 26 countries	**825 181**	**843 341**	**671 874 150**		

Notes: Figures are averages of the data available in the country summaries. Where a country summary gave ranges, midpoint values were used. Where multiple subnational datasets were provided, available cormorant population and damage estimates were aggregated before averaging. Damage refers to cormorant-related estimates only, excluding herons, otters, seals, pelicans and other predators unless the country summary did not disaggregate them. The figures presented in the columns are the averages of the data reported for the reference years.

Source: Country summaries of Annex 1.

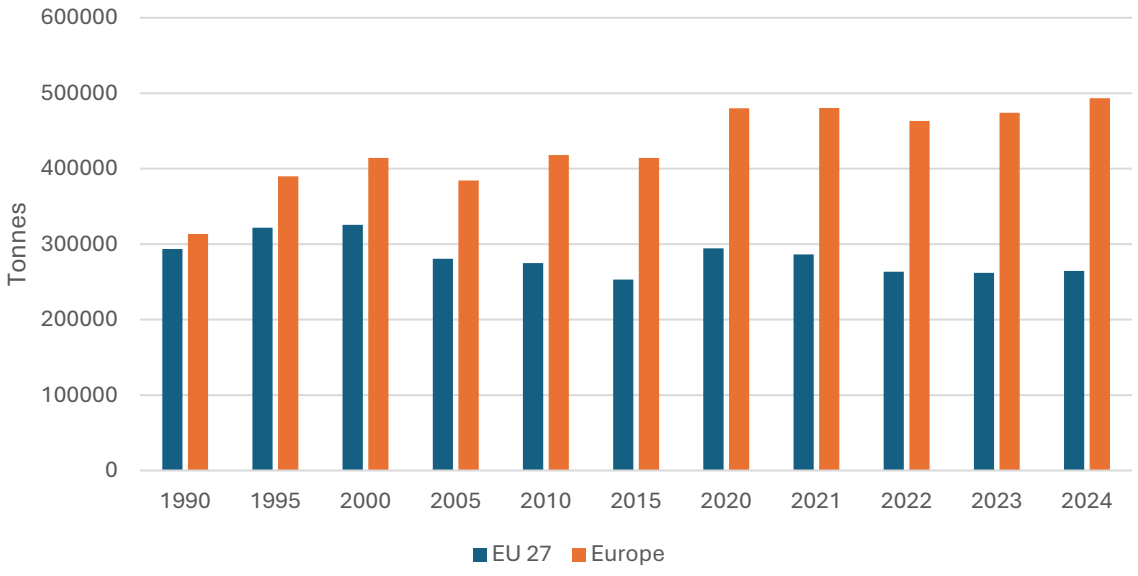
4. Freshwater aquaculture and inland fisheries in Europe

4.1 Freshwater aquaculture production

Overall, European freshwater aquaculture production increased from around 313 000 tonnes in 1990 to nearly 493 000 tonnes in 2024, corresponding to an average annual growth rate of about 1.3 percent, with major expansion observed in the Republic of Moldova, Serbia and Türkiye. In contrast, freshwater aquaculture production in the EU-27 declined over the same period, from about 294 000 tonnes to roughly 265 000 tonnes, reflecting a slight negative annual growth rate of around -0.3 percent (Figure 1). Production is highly concentrated: Türkiye dominated with about 35 percent of European output in 2024, followed by Poland (≈9 percent), France (≈9 percent) and Italy (≈7 percent). In 2024, Czechia, Hungary, Spain and Ukraine were each responsible for around 4 percent of European freshwater aquaculture production (Table A4.2).

The value of European freshwater aquaculture output has more than doubled since 1990, increasing from about USD 0.97 billion in 1990 to over USD 2.16 billion (EUR 2.08 billion) in 2024, despite only marginal increases in annual production volumes. This corresponds to an average annual growth rate of roughly 2.5 percent for Europe as a whole, with particularly strong growth occurring after 2010. In the EU-27, the value rose from about USD 0.91 billion in 1990 to USD 1.31 billion (EUR 1.26 billion) in 2024, implying a more moderate annual increase of around 1.2 percent (Figure 2), which may indicate a decline in output value if inflation over this period is considered.[2] Freshwater aquaculture production by value is concentrated in a few European countries. In 2024, Türkiye led with about 28 percent of total European freshwater aquaculture production by value, followed by France (≈11 percent), Poland (≈9 percent) and Italy (≈7 percent) (Table A4.3).

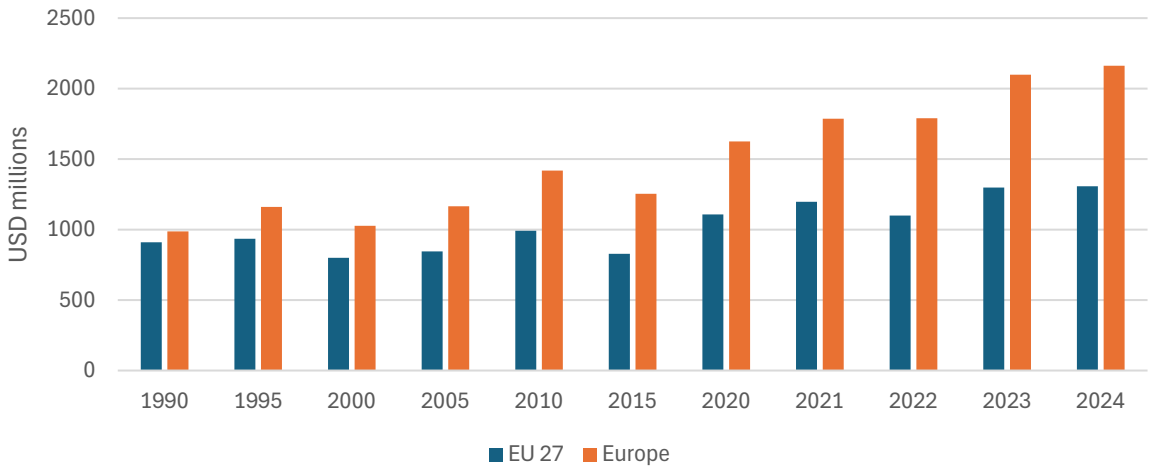
Figure 1. European freshwater aquaculture production in tonnes, 1990–2024



Note: Europe = EIFAAC membership (excluding Belarus and the Russian Federation).
Source: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ.* Available at www.fao.org/fishery/en/statistics/software/fishstatj

[2] Average annual inflation in the EU-27 over the period 1990–2022 was approximately 2.3 percent (Eurostat, 2024).

Figure 2. Off-farm freshwater aquaculture production value in Europe (USD), 1990–2024



Note: Europe = EIFAAC membership (excluding Belarus and the Russian Federation).
Source: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ.* Available at www.fao.org/fishery/en/statistics/software/fishstatj

Not all European countries report aquaculture production data disaggregated by species to FAO. Based on the data received, European freshwater aquaculture production, reported by species, fluctuated between 150 000 and 220 000 tonnes in the period 1990–2024, showing a slight long-term decline since the mid-1990s. Production is dominated by a few species, with rainbow trout and common carp consistently accounting for most of the output. In recent years, rainbow trout represents roughly 55–60 percent of freshwater aquaculture production, while common carp contributes around 20–25 percent. Other species, such as European seabass (freshwater stages), catfish and sturgeon, each account for much smaller shares (generally below 10 percent), indicating a highly concentrated species composition in European freshwater aquaculture.

Combining the data on cultured freshwater species with off-farm prices by species over the period 2020–2024 provides a comprehensive overview of average prices per kilogram for all freshwater aquaculture production in Europe.

The combination of species production volumes and off-farm prices can be used to calculate a volume-weighted average price per year:

$$\textbf{Average price} = \frac{\sum(\boldsymbol{Q_i} \times \boldsymbol{P_i})}{\sum \boldsymbol{Q_i}}$$

Using the species-level production volumes and corresponding prices, the resulting estimated European average freshwater aquaculture prices are presented in Table 2 and Table A4.1.

Table 2. Average off-farm fish prices in Europe for all species, rainbow trout, common carp and sturgeons

Year	Average fish price (EUR/kg)	Rainbow trout (EUR/kg)	Common carp (EUR/kg)	Sturgeons NEI (EUR/kg)
2020	4.55	4.18	2.47	8.39
2021	4.73	4.31	2.59	8.14
2022	5.05	4.90	3.23	9.67
2023	5.42	5.84	3.65	11.19
2024	5.68	6.21	3.68	11.53

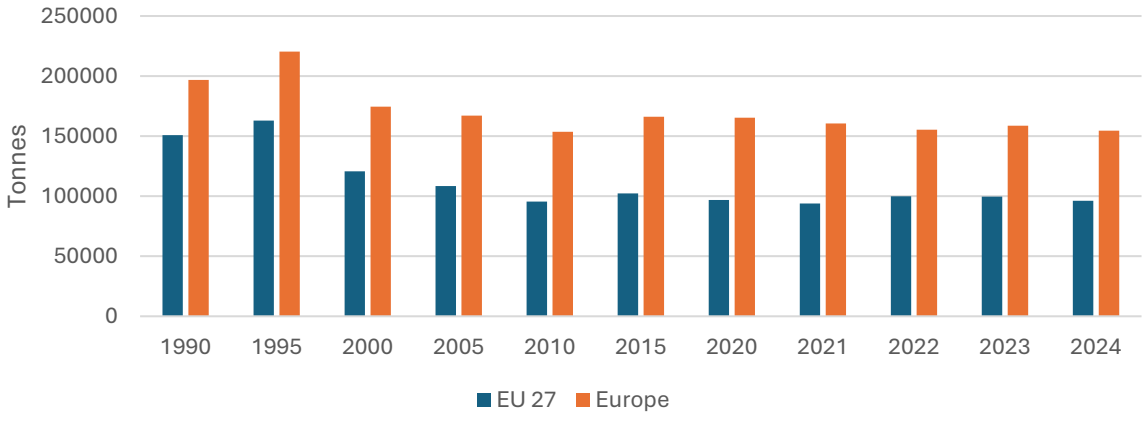
The average off-farm fish price shows a clear upward trend since 2020, increasing by 25 percent. This trend reflects price increases across key species and a gradual shift towards higher-value species. Recent evidence indicates that European aquaculture markets are increasingly influenced by species composition and value differentiation, with high-value species, such as salmonids and sturgeon, playing a growing role in overall market value and price dynamics (EUMOFA, 2025). The rise in off-farm prices after 2021 is particularly strong, aligning with broader inflation and increased market demand.

Most of the freshwater aquaculture production in Europe occurs in ponds and raceways. The estimated number of hectares used for aquaculture production in 2023 was 469 000 ha. Additionally, countries reported to FAO around 2.1 million m^3 of raceways and cages used for freshwater aquaculture, primarily for rainbow trout and other salmonids (Table A4.6).

4.2 Freshwater capture fisheries production

European inland capture fisheries production declined from about 197 000 tonnes in 1990 to around 155 000 tonnes in 2024, corresponding to an average annual decrease of roughly -0.7 percent. A similar but steeper contraction occurred in the EU-27, where production fell from about 151 000 tonnes to around 96 000 tonnes during the same period (-1.3 percent annually) (Figure 3). Freshwater capture fisheries output is highly concentrated: Finland and Türkiye (each ≈22 percent), Germany and Ukraine (each ≈10 percent) and Poland (≈9 percent) are the largest capture fisheries countries in Europe. These countries together account for a substantial share of inland capture fisheries production, although overall European output shows a long-term declining trend.

Figure 3. European freshwater capture fisheries production in tonnes,1990–2024



Source: FAO. 2026. FishStat: Global capture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ.* Available at www.fao.org/fishery/en/statistics/software/fishstatj

European inland capture fisheries have undergone notable compositional changes since 1990, alongside an overall decline in total production. Landings of low-value and widely distributed species, such as cyprinids (including roach and bream), have generally decreased, reflecting reduced fishing effort, reduced market demand, and environmental pressures in some instances. In contrast, some higher-value or stocked species, particularly pike-perch and European perch, have shown relative increases or greater stability in catches (see Arthur, 2025, for more information). In 2024, a substantial share of the total inland capture fisheries production in Europe was concentrated in a few species: cyprinids (≈30–35 percent of total volume), European perch (≈10–12 percent), pike-perch (≈8–10 percent) and Northern pike (≈6–8 percent). This highlights a gradual shift towards fewer dominant species despite declining overall landings of freshwater fish from inland waters.

The estimated landing value of European inland (freshwater) capture fisheries remained broadly stable between 2023 and 2024, at EUR 716 million in 2023 and EUR 739 million in 2024 (Table A4.5). Value is concentrated in high-value species such as pike-perch, northern pike and European perch, which together make up between EUR 180 million and EUR 200 million. In 2024, cyprinids – including common carp, grass carp, silver carp, bighead carp and Prussian carp – generated about EUR 240 million in value for fishers, despite dominating landing volumes. The average price of some carp species was relatively low (Table A4.1). In 2023–2024, salmonids, including rainbow trout and other salmonoids, contributed more than EUR 20 million annually. European eel landings were estimated at EUR 14.5 million. The category of freshwater fishes NEI was large, contributing 20 percent to the total value in 2024. Given that not all countries reported inland capture fisheries landings by species, a "non-named species" category was added to match the total landings reported by country for 2023 and 2024. The average landing value of all freshwater fish species was used for this category. The average landing value of all freshwater captured fish was EUR 3.73/kg in 2023 and EUR 3.92/kg in 2024.

4.3 Hatchery fish prices throughout Europe

Hatchery fish prices in Europe reflect regional differences in production systems (e.g. ponds, raceways, recirculating aquaculture system), input costs (e.g. feed, labour) and market orientation. Prices are relatively lower in Central and Eastern Europe, where extensive pond aquaculture dominates, and higher in Western and Northern Europe, where production is more intensive and market-driven.

For common carp (*Cyprinus carpio*), hatchery price structures are well defined across life stages. Fry (typically 2–4 cm) are generally traded in bulk at relatively low and stable prices, most commonly in the range of EUR 10–30 per 1 000 fish (equivalent to approximately EUR 0.01–0.03 per fish). Lower values are observed in Hungary, Poland and Romania, where mass production of carp larvae is practised and larvae are sold by the millions. Fry prices are slightly higher in Austria and Germany, where they are commonly sold at larger sizes (e.g. 1–2 g). Fingerlings (one-summer-old fish, typically 20–100 g) are usually priced at EUR 2–5/kg in Central Europe, increasing to EUR 7–10/kg in Western Europe (Table A4.7). In contrast, two-summer-old carp (400–800 g stocking size) show a declining price per unit biomass, typically ranging from EUR 2.5–4/kg in countries such as Czechia and Romania, EUR 4–7/kg in Austria and France, and up to EUR 12–25/kg in the United Kingdom. Compared with off-farm carp prices (approximately EUR 2.5–3.7/kg in recent years), hatchery fingerlings are relatively expensive on a biomass basis, while larger fish are often priced at farm-gate price levels in low-cost producing countries.

Grass carp (*Ctenopharyngodon idella*) prices follow a similar structure but are generally slightly higher than common carp prices. Fingerlings are typically valued at EUR 3–5/kg in Central Europe and EUR 5–7/kg in Austria and Germany, while larger fish range from EUR 4–6/kg in Poland and Romania to EUR 7–12/kg in the United Kingdom. These values remain broadly consistent with off-farm prices of around EUR 3–4/kg.

For rainbow trout (*Oncorhynchus mykiss*), hatchery prices are more standardized across Europe. Fry are generally traded at EUR 120–300 per 1 000 fish (EUR 0.12–0.30 per fish), reflecting more uniform hatchery technologies. Fingerlings are typically priced at EUR 5–8/kg in Central and Northern Europe. Prices per individual fish are considerably higher in the United Kingdom. Larger fish range from EUR 5–7/kg in countries such as Czechia and France to EUR 16–20/kg in the United Kingdom. Off-farm trout prices, at approximately EUR 6–10/kg, are broadly aligned with hatchery prices for larger trout.

Pike-perch (*Sander lucioperca*) hatchery production is more costly and variable. Fry and small juveniles are typically sold at EUR 0.5–2 per fish, while fingerlings reach EUR 10–18/kg in Central Europe and up to EUR 15–25/kg in the United Kingdom. Larger fish are priced at EUR 12–18/kg in Czechia and Poland and EUR 25–30/kg in France. These values are significantly higher than off-farm prices (around EUR 7–8/kg), reflecting the value for stocking by angling clubs, as well as the high mortality rates and production risks in early life stages.

Overall, countries such as Czechia, Poland and Romania exhibit below-average hatchery prices because of extensive pond systems and lower input costs. Germany and Hungary generally occupy an intermediate position, while Austria, Finland, France, and particularly the United Kingdom, show above-average price levels. These differences underscore the strong influence of production systems, market structure and end-use (fish stocking versus consumption) on hatchery price formation.

Across Europe, hatchery price structures indicate that smaller fish, particularly fry and fingerlings, have a significantly higher value per kilogram than larger fish. This pattern is consistent for key species such as common carp, rainbow trout and pike-perch, and is confirmed by comparisons with off-farm fish prices. The higher EUR/kg values for early life stages reflect the cumulative costs of maintaining broodstock, reproduction processes, feed (e.g. artemia), hatchery operations and high mortality risks. In contrast, larger fish benefit from biomass accumulation in relatively low-cost grow-out systems, particularly in pond-based aquaculture. This information is important for the inventory because it implies that the value of daily fish consumption by cormorants could be significantly higher than the average fish prices applied in current estimates.

5. Reported fish damage

5.1 Overview of damage types

Analysis of the data and information received shows that cormorant predation affects fish populations throughout Europe, through a combination of direct mortality, injury and behavioural disturbance, with cascading impacts on fisheries and aquaculture.

Predation by cormorants results in substantial fish losses, with reported mortality and production losses in aquaculture ponds commonly reaching 10 percent to 30 percent and exceeding 50 percent in heavily affected farms and regions. The damage caused by cormorants varies widely across Europe, depending on the production systems used on farms, farm management and the eligible predator control interventions in different countries and regions.

In addition to being consumed by cormorants, fish are frequently injured by unsuccessful attacks, leading to stress, infections and reduced growth, thereby increasing indirect mortality. Repeated disturbance by feeding flocks alters fish behaviour, causing them to aggregate in deeper waters or among the marshy vegetation along the pond shore. This also reduces their feeding activity, further limiting their growth and survival. In pond aquaculture systems, such disturbances reduce feed conversion efficiency and increase vulnerability to disease. In inland fisheries, these behavioural changes can reduce catchability, as fish become less active or shift habitats.

Overall, these processes translate into reduced yields and significant catch losses, affecting both commercial and recreational fisheries. In pond aquaculture and cage systems, farmers report measurable declines in harvestable biomass and economic returns, alongside increased variability in production outcomes. The loss of juvenile fish has a spillover effect on the entire three-year production cycle of cultured carp species. The combined effects of direct predation, sublethal injury and disturbance therefore represent a substantial and multifaceted pressure on fish stocks and associated fisheries and aquaculture production systems.

5.2 Most affected fish species

The inventory survey, additional information collected and the Framework for a European Management Plan for the great cormorant (FAO, 2026) indicate that cormorant predation affects a wide range of freshwater and coastal fish species, with impacts varying by habitat and life stage. The surveys conducted for this inventory revealed that the most affected species in inland waters include salmonids (Atlantic salmon and brown trout, particularly smolts), grayling, cyprinids such as barbel, breams, roach and bleak, percid species such as perch and pike-perch, as well as sturgeon species such as sterlet. In lakes and rivers, juvenile and stocked fish are especially vulnerable. In coastal and transitional waters, significant impacts are reported for eel, perch, pike, flounder and cod, with evidence that cormorants can consume a substantial proportion of local stocks.

Predation pressure is particularly critical for threatened and endangered species (e.g. *Zingel* spp., *Gymnocephalus* spp., *Romanogobio* spp.) and restocked species (e.g. *Acipenser* spp.), where losses can hinder stock recovery or reintroduction efforts. Overall, the species most affected by cormorant predation in Europe are typically those of high ecological or economic value, especially where populations are already depleted or concentrated in accessible habitats, increasing their vulnerability to predation.

5.3 Stocking to mitigate cormorant predation effects

Across Europe, additional stocking of fish has become a widespread mitigation response to compensate for losses caused by cormorant predation and to sustain fisheries production. The data collected for this inventory indicate that recreational fisheries organizations and aquaculture operators increasingly rely on repeated stocking to maintain fish populations and angling yields, particularly for salmonids, cyprinids and other high-value species. However, the effectiveness of stocking is often limited, as stocked fish – especially hatchery-reared individuals – are highly vulnerable to predation shortly after release, leading to repeated losses and the need for continued investment.

The Framework for a European Management Plan for the great cormorant (FAO, 2026) confirms that intensive stocking has become a key, but costly, compensatory measure, with many rivers and lakes requiring continuous restocking to sustain fisheries and biodiversity objectives.

Reported costs vary widely but are substantial: angling organizations in several countries collectively spend millions of euros annually on stocking programmes, often financed through licence revenues and volunteer contributions, while aquaculture operators incur additional costs to replace lost biomass and maintain production levels. In some cases, individual organizations report additional annual stocking expenditures exceeding EUR 100 000, particularly in systems supporting salmon, trout and carp fisheries.

While stocking can partially offset the impacts of predation, it represents a recurring economic burden and is not a sustainable long-term solution, as ongoing predation pressure reduces cost-effectiveness and undermines stock recovery efforts.

5.4 Preventive measures taken to reduce predation

Across the 26 reporting countries, fish farmers and angling organizations implement a wide range of prevention and mitigation measures to reduce cormorant predation, although with varying effectiveness and significant costs. The most commonly applied tools include active scaring (shooting, gas cannons, pyrotechnics, lasers, egg oiling and human presence), exclusion measures such as netting and overhead wires in ponds and raceways, habitat modification to reduce fish accessibility (e.g. fish refuges), restocking, and regulated culling under permit systems.

In inland fisheries, extensive volunteer effort is a key component, with angling clubs dedicating substantial time to guarding rivers and lakes and disturbing feeding birds. The value of volunteer work related to guarding ponds and angling club waters alone is considerable, reaching EUR 3.5 million annually in the United Kingdom and EUR 0.6–0.9 million in Denmark. In the Kingdom of the Netherlands total prevention costs, including volunteer labour, amount to EUR 3.0–3.4 million per year.

Overall, reported expenditures on prevention and mitigation by inland fisheries stakeholders exceed several million euros annually, with Germany alone reporting EUR 1.1 million by angling clubs and an additional EUR 5.24 million in public expenditure. In aquaculture, farmers incur additional costs for deterrents, infrastructure and labour, often amounting to hundreds of thousands of euros annually per country. Examples include EUR 1.5 million in Germany, EUR 500 000 in Finland, and EUR 348 500 in Hungary.

Most expenditure is concentrated on labour-intensive scaring activities and infrastructure investments (netting, wires and guarding); stocking and repeated interventions further increase costs. Despite many efforts, measures are often only locally effective and require continuous application, resulting in a persistent and growing economic burden on both the fisheries and aquaculture sectors.

Survey responses also showed that egg oiling is increasingly applied in Europe as a non-lethal population management measure to reduce reproductive success in cormorant breeding colonies. The

method involves coating eggs with food-grade mineral oil, which prevents gas exchange through the eggshell and stops embryo development while allowing adult birds to continue incubation behaviour. Egg oiling is considered less disruptive than nest destruction because it reduces the likelihood of re-laying and repeated breeding attempts.

In recent years, the use of drones for egg oiling has increased, particularly in breeding colonies located in trees, cliffs, islands and other areas that are difficult or dangerous to access on foot. Drone-assisted application improves operational efficiency, reduces labour costs and minimizes disturbance to surrounding habitats and bird colonies. Pilot projects using drones have been implemented in several European countries, including France and Germany (Tridge, 2025; France 3, 2024). In Baden-Württemberg, Germany, drone-based egg oiling has been applied as part of cormorant management actions around Lake Constance, while similar techniques have been used in France for the treatment of eggs in large waterbird colonies. Recent European Parliament briefings have also identified drone-assisted egg oiling as an emerging management tool within broader cormorant population control strategies (EPRS, 2026).

6. Economic impact assessment

6.1 Estimation of cormorant predation impact on aquaculture production in Europe

Cormorant predation represents a significant and unevenly distributed economic pressure on freshwater aquaculture production in Europe, with impacts concentrated in pond-based systems and major producing countries. Based on Table 3, reported damages to aquaculture amount to at least EUR 122.9 million annually for pond fish farming and EUR 15.1 million for other aquaculture systems. However, these totals are explicitly incomplete, covering just 16 countries and excluding several with limited or no reporting. The highest losses are reported in France (EUR 33.3 million), Romania (EUR 27 million), Poland (EUR 14.6 million), Croatia (EUR 7.2 million), Hungary (EUR 7.0 million) and Czechia (EUR 6.7 million), reflecting both large production volumes and extensive pond aquaculture systems.

An analysis of the country summaries indicates that predation can result in production losses of 10–50 percent at the farm level, with juvenile fish and extensively managed ponds being particularly vulnerable. Hectare-based estimates from several countries suggest losses of around EUR 500–600/ha are common, which, when extrapolated to national pond areas, align with reported country-level damages.

At the European level, off-farm freshwater aquaculture production is valued at approximately EUR 2.08 billion annually, with an estimated 469 000 ha of ponds and millions of cubic metres of raceways, recirculation and cage culture systems. However, the 16 countries that have reported on aquaculture damages and included in Table 3 represent only a portion of this total area, and major producers such as Ireland, Italy, Portugal, Türkiye, the United Kingdom and several Eastern European countries are only partially or not covered at all.

Given that reported damages in covered countries already exceed EUR 138 million annually, and assuming similar pressure levels across the broader pond aquaculture area, total predation-related losses for European aquaculture are likely around EUR 250 million per year.

The analysis is biased towards pond aquaculture impacts, which underrepresents higher-value aquaculture segments. Raceway and cage farms, particularly for rainbow trout and other salmonids, experience lower percentage losses (often 0.1–2 percent) but much higher unit values, with off-farm prices exceeding EUR 6/kg in 2024, compared to around EUR 3–4/kg for carp species. Even small proportional losses in these systems, therefore, translate into significant economic impacts. For example, Danish trout farms report combined predation and mitigation costs approaching EUR 0.7 million annually, for a relatively small production base. When such higher-value systems are scaled across Europe – including underreported or non-reporting countries, such as Bosnia and Herzegovina, Italy, Portugal, Spain, Türkiye and the United Kingdom – and combined with pond-based losses, as well as additional data on brackish- and marine water aquaculture losses, a central estimate of approximately EUR 250 million per year represents a realistic and balanced midpoint within a broader EUR 200–300 million range.

The total annual loss of aquaculture production attributable to cormorant predation in Europe is estimated at 50 000–75 000 tonnes, with a central estimate of approximately 62 500 tonnes per year. Given incomplete country coverage and underreporting in several major European aquaculture-producing countries, this estimate should be considered conservative, with actual losses potentially higher, particularly in high-value aquaculture systems and countries with limited data availability.

Table 3. Regional overview of damage by cormorants to aquaculture production

Country	Estimated total damages to pond fish farming (EUR)	Estimated total damages to other aquaculture (EUR)	Estimated total investment by farmers in prevention and mitigation of predation (EUR)	Reference years
Austria	n.a.	n.a.	n.a.	2023–2024
Belgium	388 000	n.a.	78 000	2023–2024
Croatia	7 200 000	n.a.	>=83 000 (partial)	2023–2024
Cyprus	n.a.	2 718 000	220 000	2023–2024
Czechia	6 747 000	n.a.	n.a.	2023–2024
Denmark	n.a.	689 000	254 500	2025/recent years
Estonia	175 000	n.a.	n.a.	2023–2024
Finland	n.a.	660 000	500 000	2022–2024
France	25 500 000	7 800 000	n.a.	2024–2025
Germany	6 400 000	n.a.	1 500 000	2023–2024
Greece	240 000	n.a.	n.a.	2011–2020
Hungary	7 013 000	n.a.	348 500	2023–2024
Latvia	175 000	n.a.	n.a.	2023–2024
Lithuania	1 680 000	n.a.	n.a.	2025
Republic of Moldova	n.a.	n.a.	n.a.	2023–2024
Netherlands (Kingdom of the)	limited	n.a..	n.a.	2023–2024
Norway	n.a.	n.a.	n.a.	Recent years
Poland	14 600 000	n.a.	98 500 (mixed respondents)	2023–2024
Romania	27 000 000	n.a.	n.a.	2014–2019
Serbia	10 000 000	22 000	n.a.	Recent years
Slovakia	700 000	n.a.	n.a.	2023–2024
Spain	4 118 000	2 733 000	>=14 600 (partial)	2024
Sweden	n.a.	n.a.	69 600 (all prevention)	2023–2024
Switzerland	0	0	n.a.	2023–2024
Ukraine	11 000 000	500 000	>=4 500; up to 50 000 per farm reported	2025–2026
United Kingdom of Great Britain and Northern Ireland	n.a.	0 (salmon sector)	n.a.	2025–2026
Total (incomplete)	122 936 000	15 122 000		

Notes: Values are annual averages where 2023–2024 data were available. "n.a." indicates that the country summary did not provide a separate aquaculture-specific estimate. Some entries are proxies or partial estimates where the source data do not distinguish pond farming, other aquaculture and broader fisheries/fish-stock impacts. Prevention and mitigation figures are included only where farmer-level or clearly relevant aquaculture-sector costs were reported; public monitoring, research, compensation payments and angling-club-only costs are generally excluded unless noted. The figures presented in the columns are the averages of the data reported for the reference years.
Source: Country reports in Annex 1.

6.2 Aquaculture farm losses

More than 130 aquaculture farmers from several European Union countries reported individual farm losses owing to cormorant predation (over one or more years), confirming and extending earlier estimates. Across countries, losses per farm range from around EUR 500 to more than EUR 1 million annually, with typical values around EUR 30 000–100 000 per farm. Pond-based systems are most affected, with losses generally ranging from EUR 100/ha to over EUR 600/ha, and even higher in heavily impacted areas. Reported stock losses vary widely, with average annual losses of 10–20 percent in carp, tench and mixed-species ponds, but reaching 30–70 percent in extreme cases. In contrast, trout raceway systems typically experience 1–2 percent annual losses, increasing to 40 percent of the trout stock in large-sized pond production systems. Some farmers using cage culture systems in marine waters, such as in Cyprus, Greece and Spain, reported damage caused by cormorants; however, these losses were minor compared to the damage caused to freshwater pond farming.

6.3 Aquaculture farm closures attributed to cormorant predation

Persistent cormorant predation has contributed to farm closures and a shift towards less intensive aquaculture practices in several European countries. Farmers reported that sustained losses, combined with high prevention costs and administrative constraints on effective control, reduced profitability to the point where continued operation was no longer viable. Evidence from countries such as Czechia, France, Germany and Hungary shows that some pond farms have either ceased production or reduced stocking densities and shifted to lower-input, extensive systems to limit financial risk. In Croatia and Poland, farmers report significant reductions in production intensity and, in some cases, abandonment of ponds because of repeated predation losses. These developments not only reduce overall aquaculture output but also threaten the viability of traditional pond systems, with wider implications for rural livelihoods, biodiversity management, and the maintenance of wetland ecosystems.

Reported income losses in pond aquaculture attributed to cormorant predation are often the difference between a profitable and a loss-making business (Halasi-Kovács, Gyalog and Békefi, 2023; FAO, 2024a, 2024b; Engle *et al*., 2021). However, economic viability is also influenced by administrative and regulatory constraints, including limited flexibility in applying timely control measures, permitting procedures for derogations, and compliance with environmental legislation, which can delay or restrict effective responses to predation (FAO, 2024b). Together, these factors have contributed to reduced profitability for pond farming in several countries. The number of pond aquaculture farms that have ceased operations in Europe is unknown. In the survey conducted for this inventory, many pond aquaculture farmers and some cage-culture operators indicated they are disinvesting or shifting towards more extensive, lower-risk production systems, as the combined pressures from predation by great cormorants and other protected species, such as herons (with estimated annual losses of around EUR 48 million across Europe), pygmy cormorants and otters, have increased production risks.

6.4 Estimation of cormorant predation impact on inland fisheries in Europe

Cormorant predation represents a substantial and quantifiable economic pressure on inland fisheries (recreational/angling and commercial) across the EIFAAC membership area, although reported estimates remain uneven and often incomplete. Based on the overview in Table 4, countries that provide explicit monetary estimates for inland fisheries report combined damages of approximately EUR 90–100 million annually, including major contributions from France (EUR 27.6 million), Germany (EUR 27 million), Poland (EUR 23 million), Slovakia (EUR 6.25 million), Czechia (EUR 3.65 million) and the Kingdom of the Netherlands (EUR 3.0–3.5 million) (Table 4). These figures are derived using different methodologies, including bioenergetic consumption models (bird numbers × feeding days × value of fish consumed), structured surveys of angling organizations and expert-based valuation of stock losses.

In the largest reporting countries, estimation approaches are relatively robust. In France and Germany, damage assessments are primarily based on fish consumption by cormorants, converted into economic values using species-specific price data and supported by national fisheries statistics and angling data. In Poland, estimates reflect aggregated reports from angling clubs and fish farms, capturing both direct predation losses and reduced catch opportunities. In Czechia, estimates combine population data with daily consumption values (EUR per bird per day) and are cross-validated with angling association data, which report additional damages of EUR 3–4 million annually to recreational fisheries alone. These examples demonstrate that, where data are available, damages to inland fisheries are both economically substantial and methodologically grounded.

However, many countries reported only aggregate estimated damage to fish stocks (often including inland and coastal waters and aquaculture) without separating inland fisheries impacts. These estimates, primarily based on the bioenergetic consumption model explained above (see Chapter 2, section 2.2,

and Chapter 3), are substantial, exceeding EUR 600 million annually across reporting countries, and include major contributions from Denmark (EUR 91.7 million), Sweden (EUR 80.7 million), Estonia (EUR 44–46 million), Romania (EUR 44.7 million) and Finland (EUR 40–43 million). Given that inland fisheries represent an important component of these fish resources, a proportion of these losses can reasonably be attributed to inland fisheries impacts.

The total annual (landing site) value of European inland capture fisheries is estimated at EUR 716–739 million. Comparing this with reported and inferred losses suggests that cormorant predation constitutes a significant share of the sector's economic value. A conservative extrapolation can be made by combining: (i) the EUR 90–100 million in explicitly reported inland fisheries damages; and (ii) a partial allocation (approximately 10–20 percent) of the broader fish stock damage estimates to inland fisheries. Applying this proportion to the EUR 600+ million stock-level damages yields an additional EUR 60–120 million attributable to inland fisheries.

On this basis, the total economic damage caused by cormorants to inland fisheries in Europe is estimated at approximately EUR 150–220 million annually, with a central estimate of around EUR 180 million. This range reflects both direct losses (consumption and reduced catches) and indirect effects (stock depletion and behavioural changes), while acknowledging uncertainties due to incomplete reporting and methodological differences. Overall, cormorant predation represents a major structural constraint on the productivity and economic performance of inland fisheries across the EIFAAC region. The overall damage caused by cormorants to inland fisheries in Europe ranges between 21 percent and 31 percent of the landing site value. These percentages do not include the lost added value that would have been generated along the value chain, nor the value that could have been generated by recreational fisheries stakeholders.

Table 4. Regional overview of damage by cormorant to inland fisheries, including recreational fisheries, angling and commercial inland fisheries

Country	Estimated total damages to inland capture fisheries, recreational, and sports fisheries (EUR)	Estimated total damages to inland fisheries stocks (EUR)	Estimated total investment by fishers, anglers and other stakeholders in prevention and mitigation of predation in inland waters, including the total value of volunteer hours (EUR)	Reference years
Austria	3 261 000	3 261 000	160 000	2023–2024
Belgium	Not quantified	Not quantified; open waters and leisure/competition fishing affected	Not quantified	2023–2024
Croatia	Not separately quantified	8 985 000	Not quantified	2013–2018 estimate; recent context
Cyprus	Not applicable not quantified	Not quantified for inland fisheries	Not quantified	2023–2024
Czechia	3 650 000	3 650 000	220 000 public culling incentive (approx.)	2022–2024
Denmark	Not quantified	91 680 000 (not inland-specific)	1 600 000 (= value of 38 000 volunteer hours)	2025
Estonia	Not separately quantified	44 179 000 (coastal, inland, fisheries and aquaculture combined)	Not quantified	2023–2024
Finland	Not separately quantified	40 412 000	Not quantified for inland fisheries stakeholders	2023–2024
France	27 600 000	27 600 000	Included in reported damages; no separate national estimate	2024
Germany	27 000 000	>35 000 000	1 100 000 reported by 49 clubs; 5 240 000 public expenditure also reported	2023–2024
Greece	240 000	240 000	Not quantified	2011–2020 average

Table 4 *(Cont.)*

Country	Estimated total damages to inland capture fisheries, recreational, and sports fisheries (EUR)	Estimated total damages to inland fisheries stocks (EUR)	Estimated total investment by fishers, anglers and other stakeholders in prevention and mitigation of predation in inland waters, including the total value of volunteer hours (EUR)	Reference years
Hungary	Not precisely known	>26 000 000 (natural waters estimate)	Not quantified for angling clubs	2023-2024
Latvia	Not separately quantified	2 550 000 (breeding population estimate only)	Not quantified	2023–2024
Lithuania	Not quantified nationally	6 985 000 (breeding population estimate; recreational impacts localized)	Not quantified	2023–2024
Republic of Moldova	Commercial and recreational inland fishing largely prohibited; not quantified	12 800 000	Not quantified	2023–2024
Netherlands (Kingdom of the)	3 000 000–3 500 000	28 470 000 (national fish consumption estimate)	3 040 000–3 400 000, including 540 000–900 000 for volunteer hours	2023–2024
Norway	Not quantified for inland waters	46 440 000 (mostly coastal estimate; not inland-specific)	Not quantified	2020/2021 estimates
Poland	23 000 000 (reported by 38 angling clubs and fish farmers; average)	42 347 000	98 500	2023–2024
Romania	Not separately quantified	44 720 000	Not quantified	2023–2024
Serbia	Not separately quantified	8 107 000	Not quantified	2023–2024
Slovakia	6 250 000	6 250 000 (fish stocks managed by anglers)	Included in expert estimate; no separate figure	2023–2024
Spain	No information available	35 119 000	Not quantified	2023–2024
Sweden	Reported damaged catches only; not nationally valued	80 748 000	69 600	2023–2024
Switzerland	294 000 (Lake Neuchatel commercial fisheries)	>500 000	Not quantified	2009–2023; recent estimates
Ukraine	Not separately quantified	22 100 000	Not quantified	2014–2018 population basis; recent context
United Kingdom of Great Britain and Northern Ireland	Not separately quantified	40 100 000	3 500 000 value of volunteer hours	2025–2026

Source: Compiled from the country summaries in Annex 1

6.5 Damage compensation schemes and their effectiveness

Compensation schemes for damages caused by cormorant predation exist in some countries, but they vary widely in scope, eligibility and coverage. In most cases, the compensation schemes do not fully compensate the actual losses incurred by fish farmers and angling clubs. Countries with established or reported compensation mechanisms (typically under nature protection or environmental legislation frameworks) include parts of Belgium (Flanders), Croatia, Czechia, France, Germany, Hungary, Latvia, Lithuania, Romania, Slovakia and Sweden. In contrast, several other countries, including Cyprus, Estonia, Finland, the Kingdom of the Netherlands and the United Kingdom, report no or very limited compensation, particularly for recreational fisheries. Some recreational fisher organizations emphasized

that economic compensation for damages to their fish stocks is one of the measures, but that their continued fishing on healthy fish stocks is preferred.

Where compensation is provided, it is generally partial, covering only 10 percent to 80 percent of verified damage. For example, Latvia compensates up to 80 percent of assessed losses, while in Croatia compensation rates reported at the farm level ranged between approximately 10 percent and 20 percent of total damages, indicating substantial gaps between losses and payments. In Czechia, compensation is more structured, with payments for cormorant-related damage reaching EUR 2.0–3.4 million annually in recent years, representing a significant but still incomplete share of estimated total damages of EUR 6–7 million. In several countries, compensation is conditional on the implementation of preventive measures and verification procedures, which further limits access.

Aggregating available data from 26 reporting countries suggests that total annual compensation payments for cormorant-related damage in Europe amount to approximately EUR 15–25 million, although this figure is indicative owing to incomplete reporting and differences in accounting. This is substantially lower than the combined estimated damage to aquaculture (approximately EUR 250 million) and inland fisheries (around EUR 150–220 million), implying that only about 4–6 percent of total economic losses are compensated.

Overall, current damage compensation schemes provide important but limited financial relief, with significant variation between countries and sectors. In most cases, aquaculture operators receive relatively more compensation than angling organizations. Damages to recreational fisheries are often not compensated. The large gap between total damages and compensation payments highlights that the economic burden is borne directly by producers and fisheries stakeholders and underscores the need for more consistent and comprehensive policy approaches across the EIFAAC region.

Various respondents in the survey emphasized that damage compensation should be financed through European environmental protection and biodiversity conservation funds (e.g. the European Union LIFE programme) instead of fisheries and aquaculture funds (e.g. the European Maritime, Fisheries and Aquaculture Fund), which should be targeted to the sustainable development of the fisheries and aquaculture sector in Europe.

6.6 Food security implications of cormorant predation of fish in Europe

Cormorant predation has increasingly important implications for fish availability, food supply and food security in Europe, particularly in inland and freshwater systems. The European cormorant population of approximately 2 million birds is estimated to consume approximately 365 000 tonnes of fish annually (i.e. 1 000 tonnes per day). This is equivalent to the annual fish consumption of around 16 million people, based on an average per capita intake of 22 kg/year (the EU average in 2023). The total economic value of fish consumed by cormorants in Europe exceeds EUR 1 billion annually, representing a substantial impact on the production of aquatic food systems for human use.

This predation occurs in a context where European production is already constrained. Freshwater aquaculture production amounts to approximately 493 000 tonnes annually, while inland capture fisheries contribute about 155 000 tonnes to total fish and fisheries production in Europe. Comparing these production figures with the annual fish consumption by cormorants shows that the consumption of fish by these birds equals about 74 percent of freshwater aquaculture production and is more than double the annual inland capture fisheries landings across Europe.

The implications for food security are amplified by Europe's structural dependence on imports of fish and fisheries products. The European Union imported approximately 5.9 million tonnes of fish and seafood in 2023, resulting in a negative trade balance of about EUR 23 billion annually and highlighting a significant reliance on external supply (European Commission, 2024). Total apparent consumption in

the European Union is around 10.5 million tonnes annually, with a substantial share met through imports. In this context, losses caused by cormorants reduce the capacity of European fisheries and aquaculture to contribute to the domestic food supply.

Overall, cormorant predation represents a non-negligible constraint on the availability of high-quality animal protein and micronutrients, particularly in inland regions where fish production is locally important. By reducing fish biomass, increasing production risks and limiting the recovery of fish stocks, predation undermines the efforts to strengthen food sovereignty and reduce import dependence. The scale of consumption by cormorants, when compared with human dietary needs and domestic production, highlights the strategic importance of addressing predation pressures within broader European food system and fisheries management policies.

6.7 Economic consequences of cormorant predation over time

Although this inventory study primarily covers the reference years 2023–2024, while using cormorant counts available from the 2012–2015 period, the consistency of reported impacts across countries allows for a cautious estimation of cumulative losses over the past decade. Based on the aggregated annual damage of approximately EUR 670 million reported for 26 countries and considering uncertainties in coverage and valuation, a conservative low-high range of EUR 600–750 million per year can be applied.

On this basis, the cumulative economic impact of cormorant predation on inland fisheries and aquaculture in Europe over the period 2016–2025 can be estimated at approximately EUR 6–7.5 billion. This range reflects both direct losses (fish consumed or damaged) and indirect impacts (reduced growth, lower production and additional costs), as defined in the methodology.

Given the current absence of a coordinated European management approach, the continued growth and expansion of the cormorant population is expected to further intensify predation pressure on fisheries and aquaculture systems. The Framework for a European Management Plan for the great cormorant indicates that cormorant populations have increased substantially over recent decades and continue to expand in both abundance and geographical range, with current mitigation measures proving insufficient to halt this trend (FAO, 2026).

Assuming a continuation of current trends (“business as usual”), and taking into account both population growth and increasing spatial overlap with vulnerable fish stocks and aquaculture facilities, annual economic losses may rise progressively from the current estimated EUR 600–750 million to EUR 800 million–1 billion per year over the next decade. This would result in cumulative losses in the order of EUR 8–10 billion between 2026 and 2035.

Such losses would likely be accompanied by further reductions in inland fisheries production, continued decline in pond aquaculture viability and additional farm closures, with associated impacts on employment, rural economies, food security and increasing European dependency on import of fish products. These projections underscore the economic risks of inaction and highlight the potential benefits of implementing the coordinated, adaptive Framework for a European Management Plan for the great cormorant.

7. Conclusions and recommendations

7.1 Main conclusions

The main conclusions from the EIFAAC/EAA/FEAP European inventory of fish damages caused by cormorant predation are the following:

- **High participation and coverage:** The research collected data from 26 countries (approximately 66 percent of EIFAAC members), which provided a robust evidence base on cormorant impacts across Europe, drawing on inputs from more than 300 stakeholder entities.
- **Large and expanding populations:** While estimating an overall European population of over 2 million cormorants, over 825 000 breeding cormorants were reported by stakeholders in the 26 countries, confirming sustained high abundance and wide geographical distribution.
- **Substantial economic impact:** Total estimated damage to fish stocks exceeds EUR 670 million annually across reporting countries.
- **Concentration of impacts:** Around 46 percent of total damage is concentrated in five countries (Denmark, Estonia, Norway, Romania and Sweden).
- **Aquaculture losses significant:** Reported aquaculture damage exceeds EUR 138 million annually (incomplete coverage), with extrapolated European losses of around EUR 250 million per year.
- **Inland fisheries strongly affected:** Estimated damages to inland fisheries are EUR 150–220 million annually, equivalent to 21–31 percent of the inland fisheries landing sites value in Europe.
- **High farm-level impacts:** Aquaculture pond farm losses from cormorant predation generally range from EUR 100–600+/ha, with stock losses of 10–30 percent on average, reaching up to 70 percent in extreme cases.
- **Widespread ecological effects:** Predation affects key species (salmonids, cyprinids, percids, sturgeons and eel), including threatened and protected species, undermining biodiversity and stock recovery.
- **Inefficient mitigation:** Prevention measures, such as scaring, netting and culling, are costly, labour-intensive and often only locally effective, requiring continuous application.
- **Rising economic burden:** Stakeholders spend millions of euros annually on mitigation, including significant volunteer contributions in inland fisheries.
- **Limited compensation:** Compensation schemes cover only 4–6 percent of total damages, leaving most costs borne by producers and fisheries stakeholders.
- **Structural sector impacts:** Predation contributes to farm closures, reduced production intensity and declining inland fisheries productivity, with implications for rural livelihoods and food security.

7.2 Recommendations for policymakers

Policy recommendations are the following:

- **Endorse and implement the Framework for a European Management Plan for the great cormorant:** The regionally harmonized management plan across EIFAAC countries is a balanced and adaptive plan, which recognizes the migratory nature of cormorants and ensures consistent, science-based population and impact management measures.
- **Improve monitoring and data harmonization:** Develop and agree on standardized data collection on cormorant populations, fish losses and economic impacts, including separation of inland fisheries, aquaculture and biodiversity effects, to support evidence-based decision-making.

- **Enhance flexibility and efficiency of management measures:** Streamline administrative procedures for derogations and control measures across Europe, allowing timely, locally adapted responses while maintaining compliance with conservation legislation.
- **Strengthen and harmonize compensation mechanisms:** Develop more transparent, accessible and adequately funded compensation schemes, ensuring fair coverage of verified losses across aquaculture and inland fisheries sectors, and financed by environment conservation funds.
- **Support investment in effective mitigation and innovation:** Promote research and funding for cost-effective prevention tools, ecosystem-based solutions and adaptive management approaches, thereby reducing long-term dependence on repeated stocking and labour-intensive scaring measures.

7.3 Needs for future monitoring, research and collaboration

- Include predation damage in brackish- and marine water aquaculture and fisheries losses more prominently in any future inventory survey.
- Request survey participants to provide the latest hatchery fish prices and average inland fish resources composition to better quantify the additional costs of stocking and the impact of predation on inland fish resources.
- Carry out research into the corrective (stress) factors related to bird predation effects on fish to better understand and quantify the effects in terms of seeking shelter, reduced feeding, growth and increased energetic costs.
- Investigate the position of cormorant predation in the context of fish losses by other bird and mammalian predators in inland and coastal fisheries and aquaculture.
- Collect and analyse data on cormorant days for breeding and wintering birds per country to improve estimations of damage.
- Fish farmers and fishers interested in compensation for the damages caused by predation need to actively monitor and record information on their inputs (costs of stocking, feeding, labour, and predation prevention measures), production, loss and injury of fish due to predation, and counts of predators per day.

References

Arthur, R. 2025. *Status and trends of inland fisheries in Europe.* EIFAAC Occasional Papers, No. 57. Rome, FAO. https://doi.org/10.4060/cd3884en

Asche, F., Roll, K.H. & Tveterås, R. 2025. Price interactions between capture fisheries and aquaculture. *Marine Resource Economics*, 40(1): 1–20.

Barton, B.A. 1991. Physiological changes in fish from stress in aquaculture. *Annual Review of Fish Diseases*, 1: 3–26.

BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union.

Dehnhard, N., Langset, M., Aglen, A., Lorentsen, S.-H. & Anker-Nilssen, T. 2021. Fish consumption by great cormorants in Norwegian coastal waters – a human-wildlife conflict for wrasses, but not gadids. *ICES Journal of Marine Science*, 78(3): 1074–1089. https://doi.org/10.1093/icesjms/fsab004

EAA (European Anglers Alliance). 2026. *Cormorants news and policy updates*. Brussels. [Accessed on 17 April 2026]. https://www.eaa-europe.eu/?s=cormorants&scope=news

EIFAAC (European Inland Fisheries and Aquaculture Advisory Commission). 2022. *EIFAAC Advisory note on the impact of cormorant predation on fish and fisheries in Europe*. Advisory Note 2022/1. European Inland Fisheries and Aquaculture Advisory Commission. https://openknowledge.fao.org/handle/20.500.14283/cc0250en

Engle, C.R., Christie, T.W., Dorr, B.S., Kumar, G., Davis, B., Roy, L.A. & Kelly A.M. 2021. Principal economic effects of cormorant predation on catfish farms. *Journal of the World Aquaculture Society*, 52: 41–56. https://doi.org/10.1111/jwas.12728

EUMOFA (European Market Observatory for Fisheries and Aquaculture Products). 2025. *The EU fish market – 2025 edition*. European Market Observatory for Fisheries and Aquaculture Products. Luxembourg, Publications Office of the European Union. https://eumofa.eu/documents/20124/210402/EFM2025_EN.pdf

European Commission. 1997. *Opinion of the Committee of the Regions on 'The immediate measures which need to be taken to counter the damage caused by cormorants in the European regions'* (97/C215/09). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51997IR0028

European Commission. 2024. *The EU fish market – 2024 edition*. Brussels, Directorate-General for Maritime Affairs and Fisheries (DG MARE). European Market Observatory for Fisheries and Aquaculture Products.

EPRS (European Parliamentary Research Service). 2026. *Impact of cormorant predation on EU fisheries and aquaculture*. Briefing PE 782.619. Brussels, European Parliament. https://www.europarl.europa.eu/RegData/etudes/BRIE/2026/782619/EPRS_BRI(2026)782619_EN.pdf

Eurostat. 2024. *Harmonised Index of Consumer Prices (HICP) – annual average inflation rate for the European Union*. Luxembourg, European Commission. https://ec.europa.eu/eurostat/databrowser/view/tec00118/default/table

FAO. 1988. *Report of the EIFAC Working Party on prevention and control of bird predation in aquaculture and fisheries operations. European Inland Fisheries Advisory Commission*. EIFAC Technical Paper, No. 51. 79 pp. https://openknowledge.fao.org/bitstreams/9dc36592-d3e2-45d7-b83f-e77f4e8d6b4d/download

FAO/EIFAC (European Inland Fisheries Advisory Commission). 2008. *EIFAC code of practice for recreational fisheries*. EIFAC Occasional Paper, No. 42. Rome. 45 pp. https://www.fao.org/4/i0363e/i0363e00.htm

FAO. 2024a. *Report of the workshop on management advice for reducing the impact of cormorant predation on fish and fisheries, Pula, Croatia, 8 October 2024*. EIFAAC Occasional Paper, No. 56. Rome. https://doi.org/10.4060/cd3713en

FAO. 2024b. *Proceedings of the Sixth International Carp Conference, Szarvas, Hungary, 31 August–1 September 2023*. EIFAAC Occasional Paper, No. 52. Rome. https://doi.org/10.4060/cd1566en .

FAO. 2026. *Framework for a European Management Plan for the great cormorant.* EIFAAC Occasional Paper, No. 61. Rome.

FEAP (Federation of European Aquaculture Producers). 2024. *Need for coordinated European management actions of great cormorant in the EU*. Position paper. https://feap.info/data-home/feap-positions

France 3. 2024. *"Appliquer de l'huile avec un drone": la méthode de stérilisation des œufs de goélands utilisée à Cannes* [video]. https://www.youtube.com/watch?v=OIJcbsrtiEw

Gremillet, D., Wright, G., Lauder, A., Carss, D.N. & Wanless S. 2003. Modelling the daily food requirements of wintering great cormorants: a bioenergetics tool for wildlife management. *Journal of Applied Ecology*, 40: 266–277.

Halasi-Kovács, B., Gyalog, G. & Békefi B.E. 2023. *Development a compensation system for the maintenance of natural values created by pond aquaculture in Hungary. Simplified cost option method.* Manuscript. Hungarian. 39 pp.

Hough, C. 2022. *Regional review on status and trends in aquaculture development in Europe – 2020*. FAO Fisheries and Aquaculture Circular, No. 1232/1. Rome, FAO. https://doi.org/10.4060/cb7809en

Iwama, G.K., Afonso, L.O.B. & Vijayan, M.M. 2006. Stress in fishes. In: D.H. Evans & J.B. Claiborne, eds. *The physiology of fishes*, pp. 319–342. 3rd edition. Boca Raton, Florida, CRC Press.

Keller, T.M. & Visser, G.H. 1999. Daily energy expenditure of great cormorants *Phalacrocorax carbo sinensis* wintering at Lake Chiemsee, Southern Germany. *Ardea*, 87: 61–69.

Klenke, R., Ring, I., Kranz, A., Jepsen, N., Rauschmayer, F. & Henle, K. 2013. Human–wildlife conflicts in Europe: fisheries and fish-eating vertebrates as a model case. *Fisheries Management and Ecology*, 20: 159–171.

Kohl, F. 2010. *Great cormorant* Phalacrocorax carbo *in Europe: population development 1970–2009. A documentation of EAA – European Anglers Alliance*. Issue 01, 30 April 2010. Vienna, Österreichs Kuratorium für Fischerei und Gewässerschutz (ÖKF)/European Anglers Alliance (EAA). [Accessed on 17 April 2026]. https://www.fishlife.at/wp-content/uploads/2017/06/CormPopulation-Europe-Final_issue01_per-2010-04-27-.pdf

Kortan J. & Adamek Z. 2011. Behavioural response of carp (*Cyprinus carpio*, L.) pond stock upon occurrence of hunting great cormorant (*Phalacrocorax carbo sinensis*) flocks. *Aquaculture International*, 19: 121–129.

Kortan, J., Blahová, J., Kružíková, K. & Adámek, Z. 2010. Stress responses of carp pond fish stock upon hunting activities of the great cormorant (*Phalacrocorax carbo sinensis L.*). *Aquaculture Research*, 41(3): 322–330. https://doi.org/10.1111/j.1365-2109.2010.02624.x

Kortan, J., Adámek, Z. & Flajšhans, M. 2008. Indirect manifestation of cormorant (*Phalacrocorax carbo sinensis*) predation on pond fish stock. *Knowledge and Management of Aquatic Ecosystems*, 389: 1–8.

Lemmens, P., Mergeay, J., De Bie, T. & Declerck, S.A.J. 2016. Can underwater refuges protect fish populations against cormorant predation? Evidence from a large-scale multiple pond experiment. *Fisheries Management and Ecology*, 23: 46–55.

Lima, S.L. & Dill, L.M. 1990. Behavioral decisions made under the risk of predation: a review and prospectus. *Canadian Journal of Zoology*, 68: 619–640.

Ovegård, M.K., Jepsen, N., Bergenius Nord, M. & Petersson, E. 2021. Cormorant predation effects on fish populations: a global meta-analysis. *Fish and Fisheries*, 22: 1–18.

Petersson, E. & Järvi, T. 2006. Anti-predator response in wild and sea-ranched brown trout and their crosses. *Aquaculture*, 253: 218–228.

Parkkila, K., Arlinghaus, R., Artell, J., Gentner, B., Haider, W., Aas, Ø., Barton, D., Roth, E. & Sipponen, M. 2010. *Methodologies for assessing socio-economic benefits of European inland recreational fisheries*. EIFAC Occasional Paper, No. 46. Ankara, FAO. https://www.fao.org/4/i1723e/i1723e00.htm

Ridgway, M.S. 2010. A review of estimates of daily energy expenditure and food intake in cormorants (*Phalacrocorax* spp.). *Journal of Great Lakes Research*, 36: 93–99.

Russell, I.C., Dare, P.J., Eaton, D.R. & Armstrong, J.D. 2008. Reducing fish losses to cormorants using artificial fish refuges: an experimental study. *Fisheries Management and Ecology*, 15: 189–198.

Sayer, C.A., Fernando, E., Jimenez, R.R., Macfarlane, N.B., Rapacciuolo, G., Böhm, M., ... Darwall, W.R. 2025. One-quarter of freshwater fauna threatened with extinction. *Nature*, 638:138–145. https://doi.org/10.1038/s41586-024-08375-z

Schreck, C.B., Contreras-Sánchez, W. & Fitzpatrick, M.S. 2001. Effects of stress on fish reproduction, gamete quality, and progeny. *Aquaculture*, 197: 3–24.

Schreck, C.B. 2010. Stress and fish reproduction: The roles of allostasis and hormesis. *General and Comparative Endocrinology*, 165: 549–556.

Sopinka, N.M., Donaldson, M.R., O'Connor, C.M., Suski, C.D. & Cooke, S.J. 2017. Stress indicators in fish. In: *Biology of Stress in Fish*, pp. 405–462. Academic Press.

Sunardi, T., Manatunge, J. & Fujino, T. 2007. The effects of predation risk and current velocity stress on growth, condition and swimming energetics of Japanese minnow (*Pseudorasbora parva*). *Ecological Research*, 22: 32–40.

Tridge. 2025. *New drone project against cormorants starts at Lake Constance*. [accessed on 17 April 2026]. https://www.tridge.com/news/new-drone-project-against-cormorants-starts--qevzlg

UNDRR (United Nations Office for Disaster Risk Reduction). 2017. The Sendai Framework Terminology on Disaster Risk Reduction. *Definition: economic loss*. Geneva. https://www.undrr.org/terminology/economic-loss

ANNEX 1 Country reports

Austria

Information was received from the Bundesamt für Wasserwirtschaft (Federal Agency for Water Management), which obtained the data from three federal states (provinces): Upper Austria, Styria and Vorarlberg. The data from Vorarlberg referred mainly to Lake Constance (or Bodensee, which is the German name for the lake).

The total number of non-breeding great cormorants counted in Upper Austria and Styria amounted to 931 and 909 in 2023 and 2024, respectively (Table 1). The average annual estimated damage caused by the great cormorants in these two states was EUR 606 000. Compensation was not paid in these years for damages caused by cormorants. In 2024, 74 cormorants were culled in Styria from permissions given for the culling of 115 birds. It was estimated that at least EUR 100 000 was spent annually on research into fish predation by birds in Upper Austria in both 2023 and 2024.

Some limited damage compensation was paid in Styria for the damage caused by otters. In 2023, the amount was EUR 89 000, and in 2024 it was EUR 51 000.

Table 1. Data from Upper Austria and Styria

	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population	0	0	0	0	0
Non-breeding population	931	909	210 to 365	625 000	587 000
Heron	641	768	365	224 000	268 000
Otter	911	961	365	1 769 000	1 866 000

The data received from the Lake Constance area include a breeding population of around 3 000 birds and an equally large non-breeding population in 2023 and 2024 (Table 2). The estimated damages caused by great cormorants amounted to EUR 2.8 million in 2023 and EUR 2.6 million in 2024. Permissions were given to cull 800 great cormorants, of which 700 were culled. Additionally, in 2024, the estimated damage to fish stocks in Lake Constance caused by other bird species, such as merganser, great crested grebe and herons, was EUR 2.5 million. In both 2023 and 2024, the annual costs associated with monitoring the cormorant population and related damages totalled around EUR 40 000; the other cost of EUR 20 000 per year was attributed to net damages caused by the birds.

Table 2. Data from Upper and Lower Lake Constance

	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population	3 156	2 916	120	946 800	874 800
Non-breeding population	3 220	2 933	240	1 932 000	1 759 800
Great crested grebe		6 000	360		2 073 600
Merganser		750	200		337 500
Heron		350	360		120 960

Belgium

Information was received from 13 fish farms in Wallonia, in southern Belgium, through the Collège de Producteurs (https://collegedesproducteurs.be). These farms comprise nine trout farms and four cyprinid farms, all of which provide put-and-take fishing for recreational purposes.

The total number of non-breeding great cormorants counted by the 13 fish farms was 379 in 2023 and 475 in 2024 (Table). Most birds remained in the area for more than six months. The estimated annual damage caused by great cormorants was EUR 334 000 in 2023 and EUR 442 000 in 2024. On average, each farm experienced cormorant predation damage of approximately EUR 30 000 per year. In 2024, the damage per farm ranged from EUR 9 000 to EUR 82 000.

Given that most of the farms reporting damage are put-and-take fisheries, the value of losses per kilogram of fish is relatively high. The consumer price of fish in these fisheries ranges from EUR 10 to EUR 12 per kilogram.

Most farms (eight) also reported great egrets, ospreys and black storks, which also prey on fish stocked in put-and-take ponds. The total damage caused by fish predation by these three species was estimated at EUR 290 000 in 2024, while an additional EUR 20 000 in damage was attributed to otters.

All farms invested in preventive and mitigating measures against bird predation. These measures included installation costs and consumables for gas cannons, scarecrows, pond protection nets, overhead wiring, fencing, protective cages, scare discs and balloons, firecrackers, net repair materials, pathology testing of damaged fish, and hunting (including ammunition, food and compensation). Over the period 2023–2024, the average investment in these measures was EUR 12 000 per farm, ranging from a few hundred euros to EUR 30 000.

These estimates do not include the hours spent scaring birds, fuel costs for vehicles used, or labour costs associated with removing dead fish attacked by birds and repairing nets and protective equipment.

Additional labour costs are incurred to pay hunters. Some farmers spend up to three hours per day chasing birds away from their ponds. Farms have also made substantial investments in nets and bird-scaring cannons, and several have taken loans from financial institutions that must be repaid with interest. However, the exact costs of these interest payments were not provided.

Some farms harvest fish from larger ponds and transfer them to smaller, net-covered ponds or to indoor tanks for overwintering. The farms bear the associated labour costs and the additional feed that must be provided to the fish.

Table 3. Data from 13 fish farms in Wallonia, Belgium

Species	Category	Individuals In 2023	Individuals In 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	—	—	—	—	—
	Non-breeding population	379	475	200	334 000	442 000
Heron	—	302	322	365	213 000	225 000

Note: No breeding population of great cormorants was reported by the surveyed farms.

The Collège de Producteurs and the Fédérations Halieutiques et Piscicoles agréées de sous-bassin reported that Wallonia is under increasing pressure from cormorant predation, affecting both private commercial fish farms and open waters, with significant repercussions for recreational and competitive fishing. These two economically and ecologically linked sectors are attempting to respond through coordinated efforts.

According to AVES, the Walloon ornithological association that conducts individual assessments, the wintering cormorant population in Wallonia has exceeded 2 000 individuals in recent years, with 2 170 individuals observed in January 2023. The increasing concentration of birds around fish-bearing waterbodies is exacerbating damage to fish stocks and threatening the balance of both the professional and recreational sectors.

Fish farmer organizations reported that cormorant predation has become a major obstacle to the development of fish farming in Wallonia, including the production of pond fish such as carp, roach, tench, pike, perch and pike-perch. Several unused ponds are suitable for developing extensive polyculture of these species, but predation pressure is wiping out production and discouraging many actors from taking up this type of farming.

The following issues are also regularly reported by Walloon fish farmers in relation to cormorant predation:

- Production losses: Trout and cyprinid farmers report significant losses from cormorant predation, with losses of around 50 percent in extensive cyprinid farming and 10–30 percent in trout farming.
- Increasing populations: Cormorant populations preying on fish farms are expanding rapidly, and their presence is becoming increasingly widespread throughout the year.
- Ineffective control methods: Traditional scaring methods are proving ineffective in the face of increasing cormorant density, as cormorants adapt to protective devices such as nets and cages.
- Bird behaviour: Some cormorants gather in large groups and attack ponds directly, making deterrence techniques even more difficult.
- Disease transmission: The transmission of viral fish diseases by cormorants is a major concern for aquaculturists.
- Lack of compensation: Fish farmers receive no compensation for the substantial losses caused by cormorant predation in Wallonia.

In Flanders, fish farmers may receive compensation for damage caused by herons and cormorants. Compensation is available provided that the farmer has installed or used at least one preventive measure, such as netting or lines above ponds, scarecrows, balloons or other deterrents, and that the damage exceeds EUR 300. Compensation may be requested from the Agentschap voor Natuur en Bos (n.d.). However, the administration in Flanders did not receive any damage reports related to fish predation by cormorants or herons in 2023 or 2024. It is therefore assumed that the small number of fish farmers in Flanders do not face significant problems with fish predation by cormorants.

Reference

Agentschap voor Natuur en Bos. n.d. *Visetende vogels: voorkomen en beperken van schade*. Brussels. [Cited 21 April 2026]. https://natuurenbos.vlaanderen.be/sites/default/files/documenten/visetende_vogels.pdf

Croatia

Information was received from the University of Zagreb and two fish farms. The farms are PP Orahovica, with 6 813 ha of fish ponds, and Ihor Park farm (also known as Crna Mlaka fish farm), with 645 ha of ponds.

In Croatia, cormorant monitoring is not carried out on a regular basis because cormorants are not considered a target bird species. The latest official data on cormorant breeding pairs and wintering population in Croatia, reported by the Ministry of Economy and Sustainable Development under Article 12 of the Birds Directive to the European Environment Agency (EEA), were for the period 2013–2018 and included a maximum range of 1 653 breeding pairs and a wintering population of 20 000 birds. The average daily value of fish consumed per great cormorant was estimated at EUR 2.50. Based on these assumptions, the estimated annual economic damage caused by great cormorant predation of fish was approximately EUR 9 million per year (Table 1). Given that the data are more than a decade old, the reliability of these estimates is low. Additionally, Pažur (1996) presented data on the alarming situation of predation in aquaculture and open waters. His research in the 1990s showed that the cormorant population in Croatia doubled every 3.5 years. Considering these data and the estimated number of birds in 2013, it could be expected that the cormorant population will reach at least 320 000 birds in 2026. Using this calculation, the estimated annual damage would be much higher than the estimate in Table 1. In the 1996 study, Pažur recommended radical measures at the national level and the urgent formation of an expert committee at the European level that would develop common guidelines for reducing the number of great cormorants.

Table 1. Estimated damage to fish populations in Croatia based on the average of ranges reported to the European Environment Agency (EEA) for the period 2013–2018 (assuming a stable population)

Great cormorant	Individuals (2013-2018)	Occurrence in the year (days)**	Estimated damage per year (EUR)
Breeding population*	3 300	180	1 485 000
Non-breeding population	20 000	150	7 500 000

*Data provided by Croatia to the EEA.
**Number of days in a normal year.

Monitoring in Kopački rit National Park in Croatia recorded some 760 breeding pairs of the great cormorant, the largest national colony (Bjedov *et al*., 2025). The species functions as a top piscivorous predator, exerting pressure on fish communities, including species such as Prussian carp. While direct biodiversity damage is not quantified, intensive predation may alter fish assemblages and trophic balance. The study further highlighted additional ecosystem stress through pollutant transfer, with mercury biomagnifying from fish to cormorants, indicating strong trophic linkage. Combined effects of predation and contaminant exposure suggest potential indirect impacts on biodiversity, particularly in sensitive floodplain systems where ecological interactions and pollutant dynamics are closely coupled (Bjedov *et al*., 2025). Similarly to Pažur (1996), this study gives an indication that the total number of cormorant breeding pairs in Croatia may have increased since 2018.

Aquaculture

Total aquaculture production in Croatia was more than 29 000 tonnes in 2024. The reported freshwater aquaculture production output in the same year was 4 427 tonnes (FAO, 2026). The total area of farmed fish ponds in the country is estimated at 12 639 ha, and all ponds are included in Natura 2000, where production is limited, in theory, to 500–1 200 kg/ha, according to the Ordinance on Conservation Objectives and Conservation Measures for the Target Bird Species in the Ecological Network Areas (Official Gazette 20/2020, 38/2020).

Already more than a decade ago, cormorant predation in Croatia caused substantial economic losses in aquaculture, primarily through the consumption of juvenile fish and indirect damage. Indirect impacts include fish injuries, disease susceptibility, reduced growth and lower market value, further increasing financial losses (Pažur, 1996; Piria, 2014).

Ihor Park farm reported that its carp pond production is 619 tonnes in an average year. The predation on the 645 ha of ponds kills more than 162 tonnes and damages 28 tonnes of fish annually. The annual damages to farmers' fish production caused by cormorant predation were estimated at approximately EUR 397 500 in 2023 and EUR 345 000 in 2024 (Table 2). The average damage of cormorant predation of fish was EUR 575/ha. The overall predation per hectare was estimated at EUR 1 389/ha in 2023/2024.

Table 2. Data from Ihor Park farm

	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population	390	378	300	292 500	283 500
Non-breeding population	280	165	150	105 000	61 875
Pygmy cormorant	20	22	90	4 050	4 455
Heron	348	445	365	121 939	155 928
Otter	30	30	365	58 254	58 254

Note: The predation damages caused by ducks, geese, grebes and other animals are not included in this table, but data were provided.

Ihor Park farm reported a total of around EUR 808 000 in predation-related damages in 2023. Of this, the farm received EUR 168 361 (21 percent) as compensation. This means that about EUR 640 000 (79 percent) remained as uncompensated damages that the farm had to absorb. In 2024, the farm reported a total of just over EUR 985 000 in predation-related damages but received only EUR 106 122 (11 percent) as compensation. The uncompensated damages for the farm amounted to EUR 879 000.

Ihor Park farm also reported additional annual costs due to assignment of the pond areas as a no-hunting zone. These costs were estimated at EUR 83 000 for mitigation measures and several thousands euros for beaver management.

PP Orahovica, the largest freshwater fish farm in Croatia, currently operates 6 817 ha of fish ponds. The company emphasized the significant costs associated with cormorant predation. The damage compensation received from the government is not sufficient to cover the predation damage to fish by cormorants or other predators. Although the company has not made its own calculations in recent years, it reported that the damage caused by cormorants exceeds EUR 902/ha, which is the maximum compensation value, according to the Ordinance on the implementation of state aid for damage caused by protected animals in carp ponds (103/2024; 141/2024). When calculating damages at the ordinance value of EUR 902/ha, annual damages would amount to EUR 6.2 million. PP Orahovica also noted that while the maximum compensation per hectare has remained the same for the past decade, the costs of fish production and market prices of fish have increased significantly over the same period.

In addition, the company informed the inventory study that:

- A cormorant hunting derogation was requested in 2017. It was granted for a short time but was quickly revoked.
- Nets can be placed on small fish ponds up to 1 000 m^2 to reduce a significant part of bird predation; however, fish ponds in Croatia are much larger. Ponds may be several hundred hectares in size, and the placing of protective nets is therefore not possible.

Based on predation damage data and other information received from the pond fish farms, it can be concluded that cormorants alone cause an annual damage of at least EUR 575/ha. Multiplying this conservative average damage figure with the hectares of fish ponds in Croatia, the total annual damage caused by cormorants to the country's pond fish production can be estimated at EUR 7.2 million.

Under Croatia's Prioritised Action Framework for 2021–2027, the Ministry of Agriculture provides compensation "for damage from various species of birds and other animals on carp fishponds," with a total allocation of EUR 8.7 million from 2018 to 2020 (European Commission, 2026). The same draft guidance document on the general system of protection of bird species under the Birds Directive (Articles 5 and 9 of Directive 2009/147/EC) stated that, in September 2024, compensation increased to EUR 902/ha of production area. For carp ponds in Natura 2000 sites, other measures have been implemented in Croatia. The draft guidance document states that "The premium is set at 356 EUR/ha of registered production area of a fish pond but 'cannot exceed 35% of the annual income from the sale of aquaculture products of the user achieved in the reference calendar year'". This premium was based on calculations from the "Croatia EU Natura 2000 Integration Project – NIP," which used the concept of opportunity cost by comparing the income and costs of conventional fish ponds with those of extensive ones. Compensation is paid 70 percent from the European Union budget and 30 percent from the state budget (European Commission, 2026).

References

Bjedov, D., Lončarić, Ž., Ćimović, S., Mikuška, A., Alić, S., Bernal-Alviz, J., Turić, N., Marčić, Z., Nekić, R., Kovačić, L.S., Marković, T. & Velki, M. 2025. Biomarker responses and trophic dynamics of metal(loid)s in Prussian carp and Great Cormorant: Mercury biomagnifies; arsenic and selenium biodilute. *Fishes*, 10(12): 635.

European Commission. 2026. Guidance document on the general system of protection of bird species under the Birds Directive: Articles 5 and 9 of Directive 2009/147/EC. Draft document. Brussels, European Commission.

FAO. 2026. Fishery and Aquaculture Country Profiles. Croatia, 2023. Country Profile Fact Sheets. In: *Fisheries and Aquaculture*. [Cited 24 April 2026]. https://www.fao.org/fishery/en/facp/HRV

Pažur, K. 1996. Cormorant — a problem and a possible solution. Ribarstvo, 54:173-180.

Piria, M. 2014. Utjecaj velikog vranca *(Phalacrocorax carbo sinensis)* na riblji stok – pregled. *Croatian Journal of Fisheries*, 72: 164–173.

Cyprus

Information was received from the Department of Fisheries and Marine Research of the Ministry of Agriculture, Rural Development and the Environment of the Republic of Cyprus. The department collected data from six fish farms.

The six farms cultivate seabream and seabass, primarily using cage farming systems, with associated hatcheries, nurseries and onshore ponds in coastal areas. The farms are located near Limassol Port and in Mari, Liopetri, Agios Georgios Alamanos and Vasiliko. Together, they produce approximately 5 000 tonnes of fish per year.

The number of breeding great cormorants near the six fish farms was estimated at 700 in 2023 and 800 in 2024. In 2023, the non-breeding population visiting the area was estimated at 5 100 birds, and in 2024 it was 5 150 birds. The occurrence of great cormorants throughout the year ranged from 180 to 210 days. As bird numbers increased, the estimated damage caused by predation also rose (Table).

The total estimated damage caused by great cormorants increased from EUR 2.6 million in 2023 to nearly EUR 2.8 million in 2024. However, some farmers estimated that total predation costs have exceeded EUR 3.8 million annually in recent years.

Predation by pygmy cormorants and herons also caused significant damage, estimated at more than EUR 1 million per year. Given that total aquaculture production reached 9 064 tonnes in 2024, with a value of EUR 53 million (DFMR, 2025), predation losses correspond to approximately 7 percent of the off-farm production value. In 2023, total predation damage was estimated at EUR 3.5 million, corresponding to about 10 percent of the off-farm production value.

In Cyprus, financial compensation is not available for damages caused by cormorant predation.

Table. Data from six fish farms in Cyprus

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	700	800	180–210	337 000	390 000
Great cormorant	Non-breeding population	5 100	5 150	180–210	2 302 000	2 407 000
Pygmy cormorant		2 100	2 400	180	857 000	1 000 000
Heron		1 000	1 100	365	261 000	296 000

The farms reported substantial investment in mitigation measures in 2023 and 2024. Expenditure on netting exceeded EUR 100 000 per year, and approximately EUR 12 000 was spent on gas cannons used to deter birds.

However, the largest costs relate to labour. Farms reported average additional labour costs of approximately EUR 300 per day, totalling more than EUR 108 000 per year. These costs reflect time spent on bird deterrence and related activities.

Reference

DFMR (Department of Fisheries and Marine Research). 2025. *Cypriot aquaculture 2024*. Ministry of Agriculture, Rural Development and Environment. Nicosia. [Cited 21 April 2026]. https://www.moa.gov.cy/moa/dfmr/dfmr.nsf/All/CF42DB069283278342257E960035E13B/$file/Cypriot%20Aquaculture%202024.pdf

Czechia

Information was received from the Ministry of Agriculture, the Czech Fish Farmers Association and the Czech Anglers Union (Český rybářský svaz).

Neither the Ministry of the Environment nor the Nature Conservation Agency of the Czech Republic has recent data on cormorant counts. BirdLife International reported a range of 230–320 breeding pairs in Czechia in 2014–2017 and 11 900–14 200 wintering individuals in 2015–2019 (BirdLife International, 2021). Wintering numbers in the European Union have increased by 5.8 percent annually over the long term. However, a stable wintering cormorant population in Czechia was reported by Nagy and Langendoen (2025). The most recent Birds Directive Article 12 reporting submitted by Czechia to the European Environment Agency (EEA) indicates a range of 300–500 breeding pairs and a wintering population of 8 000–13 000 great cormorants.

The estimated average number of breeding individuals was 800 great cormorants, while the wintering (non-breeding) population was estimated at 10 500 birds. In the absence of more recent official data, these estimates were used for the 2023–2024 period. The average daily value of fish consumed by a great cormorant was estimated at EUR 2.50. Based on these assumptions, the estimated annual economic damage caused by great cormorant predation on fish was approximately EUR 4.4 million (Table 1).

Table 1. Estimated damage to fish populations in Czechia based on the average of ranges reported to the EEA for the period up to 2018 (assuming a stable population)

Species	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)**	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population*	800	800	180	360 000	360 000
Non-breeding population*	10 500	10 500	150	3 937 000	3 937 000

*Data provided by Czechia to the EEA for 2022. *Source*: https://sdi.eea.europa.eu/data/0801ff11-24ae-4c6b-852f-029965df5bc5?path=%2F

**Number of days in a normal year.

Given that the data in Table 1 are more than a decade old, the reliability of these estimates is low. A more reliable estimate originates from the Czech Fish Farmers Association and the Czech Anglers Union, which have counted great cormorant breeding pairs and wintering birds since 2019. The latest available data from the farmers' association for 2022, 2023 and 2024 are presented in Table 2. Reporting farms account for 90 percent of Czech aquaculture production. Estimated damages caused by cormorants amounted to approximately EUR 4.6 million in 2022, EUR 6.0 million in 2023, and EUR 7.4 million in 2024.

Table 2. Estimated damage to fish populations in Czechia based on data from the Czech Fish Farmers Association and the Czech Anglers Union

Species	Individuals in 2022	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2022 (EUR)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population	824	820	1 235	349/344	541 640	706 040	1 081 360
Non-breeding population	14 242	14 223	15 572	153/150	4 092 000	5 346 160	6 357 840
Heron	7 154	6 627	6 782	299/304	1 473 640	1 934 720	1 944 560
Otter	3 278	3 156	3 487	344/347	4 518 520	5 834 120	6 182 680

The estimated daily value of fish consumed by a great cormorant was EUR 1.88 per bird per day in 2022 and EUR 2.50 in 2023. The estimated daily value of fish consumed by a heron was EUR 0.69 in 2022 and EUR 0.95 in 2023. The estimated daily value of fish consumed by an otter was EUR 4.01 per individual in 2022 and EUR 5.32 in 2023.

These values are based on the price list used by the Czech Fish Farmers Association for determining damage to fish stocks and updated annually each June. The price list was compiled using data from 35 member entities. Median values were assessed by an expert panel of 12 members, comprising representatives from aquaculture enterprises, academia, fisher associations and the Ministry of Agriculture.

The impact of cormorant predation on inland fish resources, as reported by the Czech Anglers Union, was also significant. In 2022, anglers estimated the total damage to their fish stocks caused by cormorant predation at approximately EUR 4.3 million, of which 97 percent was caused by the wintering population. In 2023, the total damage caused by cormorant predation was estimated at EUR 4.0 million. In 2024, the estimated damage declined to EUR 3.0 million.

It should be noted that, in 2013, the great cormorant was removed from Annex III of Decree No. 395/1992 Coll. pursuant to Decree No. 393/2012 Coll., which implements provisions of the Czech Nature and Landscape Protection Act. As a result, the great cormorant was removed from the category of endangered species on the list of specially protected animals (Šedina, 2013). Following the termination of its protected status, the great cormorant could be culled; however, culling remains subject to the granting of a derogation. Compensation for cormorant-related damage is still paid under Act No. 115/2000 Coll. on Compensation for Damage Caused by Selected Specially Protected Animals.

The Ministry of Finance reported that, in 2022, compensation amounting to EUR 2 021 886 was paid for damage to fish stocks caused by cormorants, while EUR 1 349 461 was paid for damage caused by otters. In 2023, compensation payments increased to EUR 2 887 920 for cormorant-related damage and EUR 1 194 637 for otter-related damage. In 2024, compensation for damage caused by cormorants reached EUR 3 068 032, whereas compensation for otter-related damage amounted to EUR 1 555 798. In 2025, the Ministry of Finance reported compensation payments of EUR 3 434 054 for cormorant-related damage and EUR 1 471 441 for damage caused by otters.

Currently, the main population management tool used in Czechia is regulated culling. This measure is supported through a financial incentive system, with hunters receiving approximately EUR 20 per culled cormorant. Annual public expenditure for this measure amounts to roughly EUR 220 000. The number of culled cormorants and the related financial support are shown in Table 3.

Table 3. Number of culled cormorants and eligibility for financial support in Czechia, 2022–2025

Year	Number of culled cormorants	Eligibility for financial support (EUR)
2022	9 489	189 780
2023	10 271	205 420
2024	11 947	238 940
2025	10 834	216 680

In Czechia, there are around 52 000 ha of fish ponds in use (Fousová, Koubová and Jiroudová, 2021). The area of ponds and valley reservoirs used for fish farming is 41 000 ha; however, the area of reservoirs is insignificant in the balance of fish farming. In 2021, average fish production was 471 kg/ha per year (Fuksa, 2024). Total fish pond production was approximately 18 600 tonnes in 2023, with an off-farm value of EUR 50.6 million (European Commission, 2023).

Considering that the estimated damage from cormorant predation was approximately EUR 6 million in 2023, the output value of pond aquaculture could have been about 12 percent higher without predation. When the estimated damage to aquaculture caused by predation from herons and otters is also taken into account (i.e. EUR 7.7 million), total predation damage rises to 27 percent in 2023.

References

BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union.

European Commission. 2023. *Czech Republic: fisheries and aquaculture country profile*. European Market Observatory for Fisheries and Aquaculture Products (EUMOFA). [Cited 21 April 2026]. https://eumofa.eu/documents/20124/35683/Czech%2BRepublic.pdf/85838562-ba46-4fc6-943a-e74972d357b7

Fousová, E., Koubová, J. & Jiroudová, L., eds. 2021. *Zpráva o stavu vodního hospodářství České republiky v roce 2020*. Praha, Ministerstvo zemědělství & Ministerstvo životního prostředí. 151 pp.

Fuksa, J. 2024. Fishponds as an element of surface waters network: overview, history, function. *VTEI – Water Management Technical and Ecological Information Journal*, 3/2024. [Cited 21 April 2026]. https://www.vtei.cz/en/2024/06/fishponds-as-an-element-of-surface-waters-network-overview-history-function

Nagy, S. & Langendoen, T. 2025. *Trends of wintering waterbirds in the European Union: 2025 update*. Ede, the Netherlands, and Brussels, Belgium, Wetlands International Europe. [Cited 21 April 2026]. https://www.wetlands.org/download/13543/?tmstv=1774894729

Šedina, P. 2013. Vyřazení kormorána velkého ze seznamu zvláště chráněných druhů. *Ochrana přírody*, 3/2013. [Cited 21 April 2026]. https://www.casopis.ochranaprirody.cz/pravo-v-ochrane-prirody/vyrazeni-kormorana-velkeho

Denmark

Information was received from the Danish Technical University (DTU), Aarhus University and Danmarks Sportsfiskerforbund (the Danish Sports Fishing Association), and the Danish Aquaculture Producer Organization through the Danish Ministry of Food, Agriculture and Fisheries.

The latest count of occupied great cormorant nests was done in 2025. The count registered a total of 31 157 nests in the country, which was an increase of 2.2 percent compared to 2024. The report of the count states that, since 2014, the Danish population of great cormorants has been stable at 30 000–33 000 pairs (Table). The current population size is around 20 percent lower than the 1996–2005 period, when the population peaked at around 40 000 pairs (Sterup and Bregnballe, 2025a). The report also found that, of the seven areas defined to track regional differences in the development of breeding cormorants, there was an increase in four regions and a decrease in three. A total of 88 cormorant colonies were found. The country's largest colony was Stavns Fjord with 2 010 nests; another eight colonies had over 1 000 nests each.

The report by Sterup and Bregnballe (2025b) also includes information on management measures taken. The Danish Nature Agency, under the Ministry of the Environment, implemented management measures in 2025 to reduce breeding success in ten colonies and gave private landowners permission to undertake management in one colony. Management took place on 3 216 nests (10.3 percent of all active nests), primarily by preventing the eggs from hatching by spraying them with vegetable oil. The proportion of nests exposed to management measures was lower than in 2016–2024, but higher than in 2010–2015. The report does not mention the number of wintering cormorants.

Table. Data from Denmark

S	Individuals In 2023	Individuals in 2024	Individuals in 2025	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)	Estimated damage in 2025 (EUR)
Great cormorant breeding population	61 534	60 562	62 315	365	56 150 000	55 263 000	56 862 000
Non-breeding population*	39 000	40 000	38 000	365	35 588 000	36 500 000	34 675 000

*Based on a rough estimate of 100 000 cormorants active daily in Denmark throughout the year.
Sources: Breeding population data are from Sterup and Bregnballe (2023 and 2025a,b).

In 2016, Birdlife International (2021) estimated the number of wintering birds in Denmark at 15 300–15 400, referring to a study by Nielsen *et al*. (2019), which details the migration of some of the Danish cormorants to France during the winter. No information is provided on how the estimate was made.

The Danish Technical University shared that the official estimate of fish consumption by cormorants in Denmark is 18 250 tonnes per year, which is based on 100 000 cormorants and equates to 50 tonnes of fish consumed per day by cormorants, caught in rivers, lakes and coastal waters. Earlier research, based on methods used by Nielsen (1999), estimated that fish consumption by cormorants in Denmark was 15 800 tonnes in 2014.

Recreational fisheries

Danmarks Sportsfiskerforbund, which comprises approximately 115–120 member angling associations, shared information on cormorant regulation in Denmark, which involves a structured sequence of volunteer-based tasks: securing access and permissions from landowners and rights holders; preparing and submitting permit applications with required documentation; planning operations by identifying key sites, timing, personnel and logistics; ensuring equipment readiness and legal compliance; executing control actions within permit conditions while optimizing efficiency and minimizing disturbance; collecting field data on take and location; retrieving and handling birds according to

regulations; and completing mandatory reporting both to permit holders and national hunting statistics systems. These steps collectively ensure legal compliance, operational coordination and data accountability. In coordination with cormorant researchers in Denmark, it was estimated that one hunter can regulate, on average, 0.6 cormorants/hour.

To regulate cormorants (through hunting and scaring) in Denmark alone costs tens of thousands of volunteer hours per year. Based on information collected by Danmarks Sportsfiskerforbund, a rough estimate could be made of the hours spent by volunteers scaring and hunting cormorants in Denmark in 2025. The number of volunteer hours was approximately 38 000 hours (Danmarks Sportsfiskerforbund, 2026).

In accordance with international statistical standards, the economic value of volunteer work can be estimated using a replacement cost approach, valuing volunteer time at the wage rate of equivalent paid labour (ILO, 2011; OECD, 2018). Ibsen and Habermann (2006) prepared a sector-specific replacement wage based on employment in the social, cultural and association-based nonprofit sector, rather than an average wage for the whole Danish economy, which was in 2004 already 194 DKK/hour (EUR 26/hour). Average wages in Denmark have increased by approximately 70 percent since 2004. Applying this increase to the benchmark hourly wage used in the Danish volunteer sector study results in an estimated current equivalent of approximately EUR 44/hour. The total annual economic value of volunteer work performed by the angling clubs in 2025 to prevent and mitigate the damages caused by cormorants was therefore around EUR 1.6 million.

Cormorants predating fish on a river in Denmark. © Niels Jepsen

The Danish Fish Stocking Programme (2024), implemented by DTU Aqua, combines scientific advice, stock enhancement, habitat restoration and monitoring to support sustainable fisheries. Activities include fish stocking in freshwater and marine systems, developing management plans and restoring rivers to improve natural reproduction and ecological status in line with European Union directives. The programme emphasizes the use of local genetic stocks and collaboration with authorities, stakeholders and volunteers. Research and monitoring address population dynamics, migration and environmental pressures. Annual fish stocking expenditure is approximately DKK 11.1 million (~ EUR 1.5 million), with additional monitoring costs of EUR 400 000. The report acknowledges predation as a factor influencing fish populations but does not explicitly address cormorant predation or management (DTU Aqua, 2024). However, preliminary findings from ongoing projects on grayling, such as the ProtectFish project, show that cormorants consume

a large portion of the fish biomass in various streams included in the research and that monitoring by volunteers helps to deter cormorants and supports grayling recovery (ProtectFish, 2025).

In 2024, the total inland catch was 74 tonnes, with a landing value of almost EUR 270 000 (Eurofish, 2026).

Aquaculture

in 2024, the Danish aquaculture sector consisted of 173 farms and produced 53 000 tonnes of fish. The largest group of farms (65) used recirculation systems, which produced more than 27 000 tonnes, and there were 11 sea farms that produced over 11 000 tonnes. Additionally, 57 traditional freshwater farms, which use pond/raceway production systems, produced 6 729 tonnes (DST, 2024). The total off-farm output of Danish aquaculture farms was approximately EUR 234 million,[3] with the 57 traditional freshwater farms having an output value of EUR 34.9 million.

The Danish Aquaculture Producer Organization collected information on damage caused by cormorant predation at nine freshwater raceway farms, one freshwater pond farm and ten marine cage culture farms. In 2025, the nine raceway farms had a production area of 82 800 m^3 and their average size was 9 200 m^3. Together, they produce an average of 8 900 tonnes of rainbow trout per year, and the percentage of fish killed by cormorants ranges between 0.1 and 1 percent per year. The estimated total damage caused by cormorants to fish in raceways is valued at EUR 110 000/year. The raceway farms also spend, on average, EUR 11 000 per year (EUR 105 500 in total) on preventive and mitigation measures to reduce cormorant predation of fish.

The ten marine cage culture farms also grow rainbow trout. Their total annual production in recent years was 6 840 tonnes of fish (i.e. 63 percent of total Danish marine cage culture production). The farmers reported losses due to cormorant predation of fish of 0.1–1 percent/year. Their total estimated damage caused by cormorant predation was EUR 285 000/year in recent years. Together, the farms spent EUR 149 000 per year on preventive and mitigation measures to reduce cormorant predation of their fish. Applying the collected data for the entire marine cage culture farming sector in Denmark gives a total of EUR 689 000 of combined cormorant related damages and prevention/mitigation costs per year for the sector.

[3] The average exchange rate of the Danish kroner to the EUR in 2024 was 1 DKK = 0.134 EUR.

References

BirdLife International. 2021. *European Red List of Birds*. Luxembourg: Publications Office of the European Union.

Danmarks Sportsfiskerforbund. 2026. *Cormorant regulation in Denmark – volunteer workflow and effort estimation*. Unpublished communication/document prepared for stakeholder consultation. Denmark.

DST (Statistics Denmark). 2024. *Aquaculture*. Copenhagen, Denmark. https://www.dst.dk/en/Statistik/emner/erhvervsliv/fiskeri-og-akvakultur/akvakultur

DTU Aqua (Technical University of Denmark, National Institute of Aquatic Resources). 2024. *Handlingsplan for Fiskeplejen 2024 – Detaljeret aktivitetsbeskrivelse*. Denmark. https://lfst.dk/Media/638561977453947480/Handlingsplan_for_Fiskepleje_2024_-_aktiviteter.pdf

Eurofish. 2026. *Denmark*. By J. Dohmen. Country profile. https://eurofish.dk/member-countries/denmark

Ibsen, B. & Habermann, U. 2006. *Den frivillige sektor i Danmark: omfang og betydning*. Copenhagen, The Danish National Institute of Social Research (SFI). (Socialforskningsinstituttet report 06:19).

ILO (International Labour Organization). 2011. *Manual on the Measurement of Volunteer Work*. Geneva.
https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@stat/documents/publication/wcms_162119.pdf

Nielsen, E. 1999. *Skarv prædationens påvirkning af torsk i vestlige Østersø*. DFU rapport.

Nielsen, R.D., Holm, T.E., Clausen, P., Bregnballe. T., Clausen, K.K., Petersen, I.K., Sterup, J., Balsby, T.J.S., Pedersen, C.L., Mikkelsen, P. & Bladt, J. 2019. *Fugle 2012–2017*. NOVANA. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 264 s. Videnskabelig rapport nr. 314 http://dce2.au.dk/pub/SR314.pdf

OECD (Organisation for Economic Co-operation and Development). 2018. Including unpaid household activities: an estimate of its impact on macro-economic aggregates. Paris.

ProtectFish. 2025. *ProtectFish fieldwork in Denmark: more fish in the rivers*. https://protectfish.eu/protectfish-fieldwork-in-denmark-more-fish-in-the-rivers/

Sterup, J. & Bregnballe, T. 2023. *Danmarks ynglebestand af skarver i 2023*. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 42 s. Teknisk rapport nr. 294.

Sterup, J. & Bregnballe, T. 2025a. *Danmarks ynglebestand af skarver i 2024*. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 41 s. Teknisk rapport nr. 328.

Sterup, J. & Bregnballe, T. 2025b. *Danmarks ynglebestand af skarver i 2025*. Aarhus Universitet, DCE – Nationalt Center for Miljø og Energi, 42 s. Teknisk rapport nr. 360. https://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Tekniske_rapporter_350-400/TR360.pdf

Estonia

Information was received from the Ministry of Regional Affairs and Agriculture of Estonia, which collected data from five aquaculture pond farms culturing carp, pike-perch, tench, asp, common carp, rainbow trout and crayfish.

The farms are located near Haaslava village, Jõune küla, Kalakasvatuse and Kurtna küla (Saku vald, Harjumaa). Together, they produce approximately 330 tonnes of fish per year on 152 ha of pond area.

The total estimated annual damage to fish stocks reported by these farms from cormorant and heron predation ranged between EUR 105 000 and EUR 120 000. Farmers noted that predation on high-value species such as pike-perch and asp results in disproportionately high losses.

The total freshwater pond area in Estonia is approximately 178 ha. Aquaculture is also practised in freshwater and brackish-water flow-through systems. Extrapolating reported damage to the national aquaculture sector suggests total annual losses of approximately EUR 150 000–200 000.

The number of breeding great cormorants in the country was estimated at 81 100 in 2023 and 87 200 in 2024 (Table). The occurrence of great cormorants throughout the year was approximately 210 days, with an increasing trend observed in recent years.

The estimated total damage to fish stocks in coastal and inland waters, fisheries and aquaculture caused by great cormorant predation amounted to EUR 42.6 million in 2023 and EUR 45.8 million in 2024.

Table. Data on the number of cormorants and grey seals in Estonia

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	81 100	87 200	210	42 577 000	45 780 000
Great cormorant	Non-breeding population	–	–	–	–	–
Grey seal (*Halichoerus grypus*)	–	6 324	7 393	365	–	–

Source: Ministry of Regional Affairs and Agriculture of Estonia.

Estonia does not have a compensation scheme available for farmers, fishers or fisher organizations for damage caused by cormorants. Data on the populations of herons and otters are not collected at the national level.

Scientific studies indicate that grey seals consume between 4 kg and 7 kg of fish per day (Mansfield and Beck, 1977; Keszka *et al*., 2020). Assuming an average consumption of 5 kg per day and an average fish price of EUR 4/kg, the estimated annual consumption by more than 7 000 grey seals exceeds EUR 51 million.

The Ministry of Regional Affairs and Agriculture spent EUR 33 334 in 2023 and EUR 27 580 in 2024 on national monitoring of the breeding population of the great cormorant. Information on investments in preventive measures by fish farmers is limited. Some farms have invested in netting and gas cannons, while most rely on labour-intensive bird-scaring activities, the costs of which have not been quantified.

References

Keszka, S., Panicz, R., Stepanowska, K., Biernaczyk, M., Wrzecionkowski, K. & Zybała, M. 2020. Characteristics of the grey seal (*Halichoerus grypus*) diet in the Vistula River mouth (Mewia Łacha Nature Reserve, southern Baltic Sea), based on osteological and molecular studies of scat samples. *Oceanologia*, 62(3): 387–394.

Mansfield, A.W. & Beck, B. 1977. *The grey seal in eastern Canada*. Fisheries and Marine Service Technical Report, No. 704. Department of the Environment, Fisheries and Marine Service, Canada. 81 pp.

Finland

Information was received from the Natural Resources Institute Finland (Luke). The Table was prepared based on the results of monitoring the great cormorant population, coordinated by the Finnish Environment Institute (SYKE). Monitoring indicates an increase of 14 percent (approximately 3 460 nests) in Finland's nesting population from 2022 to 2023 (SYKE, 2024).

The combined estimated number of breeding and non-breeding great cormorants in the country was approximately 84 000 birds in 2023 and 96 000 birds in 2024. The estimated annual damage caused by great cormorants was EUR 37.7 million in 2023, increasing to EUR 43.1 million in 2024. No compensation was paid in these years for damage caused by great cormorants.

Permissions for culling were granted for 1 284 birds in 2023 and 1 510 birds in 2024; however, the actual number of birds culled is not known. In the same years, annual damage to fish caused by herons was estimated at EUR 604 800, and damage caused by otters was estimated at approximately EUR 7.8 million.

The estimated annual cost of netting fish ponds to protect production from cormorant and heron predation was approximately EUR 500 000. Additional costs related to monitoring and scaring predatory birds are substantial, but exact figures are not available.

The Ministry of the Environment of Finland financed a research project in 2022–2023 to assess the direct effects of birds on commercial fisheries and aquaculture. Direct effects included only verified damage to fish in traps and farms. The project had a budget of EUR 1 million from the Ministry and was supported by EUR 250 000 from the Natural Resources Institute Finland (Luke).

The main findings estimated annual damage to fish farms at approximately EUR 660 000 (Westerbom *et al*., 2024), while acknowledging that actual losses may be higher. The study also estimated that total annual losses for a pond producing 50 tonnes of fish could reach approximately EUR 86 000 under maximum loss scenarios, including inventory loss, operating profit loss and reduced feed efficiency. This estimate is consistent with previously reported farm-level losses of up to EUR 90 000 (Alioravainen *et al*., 2022, unpublished).

Table. Data on great cormorants, herons and otters in Finland

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	55 840	63 900	180	25 128 000	28 755 000
Great cormorant	Non-breeding population	27 920	31 950	180	12 564 000	14 377 500
Heron	–	3 000	3 000	210	604 800	604 800
Otter	–	4 000	4 000	365	7 767 200	7 767 200

Source: Natural Resources Institute Finland (Luke).

Cormorants nesting in Pori, on Finland's West Coast (drone footage). © Antti J. Lind/SYKE

References

Alioravainen, N., Pellikka, J., Forsman, L., Söderkultalahti, P. & Kankainen, M. 2022. *Rauhoitettujen eläinten vesiviljelylle aiheuttamat vahingot vuonna* 2021 [unpublished manuscript].

SYKE (Finnish Environment Institute). 2024. *Finland's great cormorant population grew by more than ten percent*. Press release. Helsinki, 29 August 2024. [Cited 21 April 2026]. https://www.sttinfo.fi/tiedote/70460429/finlands-great-cormorant-population-grew-by-more-than-ten-per-cent?publisherId=69819243&lang=en

Westerbom, M. *et al*. 2024. *Direct impacts of cormorants and grey herons on fisheries and aquaculture*. Finland, Helsinki, Natural Resources Institute.

France

Information was received from the Ministry of Ecological Transition, Biodiversity, Forestry, Sea and Fisheries of France, 16 departmental federations for fisheries and the protection of the aquatic environment, and the French aquaculture sector (including Fédération Française d'Aquaculture, Étangs de France).

The Ministry shared that the number of cormorants is counted/estimated every three years. Therefore, 2021 data were provided instead of 2023 data. The 2024 data were obtained from a count during the 2023/2024 winter period and by counting nests in the 2024 breeding season.

The estimated number of breeding pairs in 2024 was 10 824 ± 23 pairs (Marion, 2024), and the wintering population was estimated at 119 939 individuals (Marion, 2025). The average daily fish consumption by cormorants amounts to 0.5 kg of fish per cormorant per day, equivalent to EUR 2.50/bird per day (based on EUR 4.00/kg and a correction factor of 1.25).

Based on the estimated number of birds and the average value of fish consumed, the annual damage caused by cormorants to fish, fisheries and aquaculture in France could be estimated at more than EUR 35 million in 2024 (see Table and the notes), which is likely an underestimation.

Table. Estimate of damage caused to fish based on breeding pair and wintering individuals estimates (Marion, 2021, 2022, 2024, 2025) and average European fish prices

	Individuals in 2021*	Individuals in 2024	Occurrence in the year (days)**	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population	22 890 (= pairs × 2)	21 648	150	8 584 000	8 118 000
Non-breeding population	115 127	119 939	90	25 904 000	26 986 000

*Data for 2023 were not available. Therefore, the 2021 counts of breeding pairs and wintering population (January count) were provided (see Marion, 2021, 2022).

**The number of days occurrence of breeding cormorants may be an underestimation, as a breeding season of 150–180 days is common. Additionally, the number of migrating birds in winter is high. Winter migration includes transiting birds en route to other countries as well as birds migrating to or from France and within the country.

The approximately 22 000 breeding cormorants in France do not include the offspring (e.g. one- and two-year immature birds), failed breeders and old birds. The country functions as a major staging and redistribution zone; thus, the migration of thousands of cormorants in spring and autumn should be added to the numbers counted. The migration time is approximately 90–120 days in autumn (September to December) and 30–60 days in spring (February to April), with a peak in March.

According to the Ministry's report, the great cormorant is a protected species in France and cannot be hunted. However, permits were issued to hunt up to a maximum of 27 892 cormorants for the 2022/2023 and 2023/2024 seasons. In the 2022/2023 hunting season, 16 669 cormorants were reported shot, compared to 15 935 in the 2023/2024 season. In France, permits to shoot cormorants are mainly issued to prevent and mitigate damage to pond aquaculture.

Compensation for damages caused by cormorants to aquaculture and fisheries resources is not available in France.

The French Ministry of the Environment emphasizes that the data provided below by fishing federations and the aquaculture sector must be interpreted with caution, as they are based on varying local estimates. Nevertheless, feedback from the field and technical studies confirm the significant predation pressure

from the great cormorant, particularly in pond aquaculture. The data presented in this report should therefore be regarded as indicative of the order of magnitude of the damage suffered.

A forthcoming study comparing protected and unprotected fish farms could help to refine these estimates further.

Reported cormorant damage to recreational fisheries in France

The French national fisheries association, the Fédération Nationale de la Pêche en France, includes 94 departmental federations for fisheries and the protection of the aquatic environment (Fédérations Departementales de Pêche et de Protection du Milieu Aquatique), which represent around 3 400 local angling associations (called AAPPMA) and around 1.5 million anglers (FNPF, 2026).

Fifteen of the departmental federations shared information on the damages caused by cormorants to their fish stocks and the angling activities of their member angling clubs.

The 15 departmental federations own or manage fish stocks and fisheries of more than 35 000 ha of lakes and reservoirs, as well as thousands of kilometres of river stretches in these departments. In 2024, the reported number of wintering cormorants totalled more than 19 000 birds, unevenly distributed among departments: the highest reported bird numbers were in Haute-Garonne (3 648), Lot-et-Garonne (2 922) and Aude (1 876), with several other departments reporting around 900–1 200 birds. The reported estimate for cormorant-days is incomplete, but averages of about 174 days were provided, suggesting a long seasonal presence rather than a short passage only. The number of birds counted in 2024 was less than 18 000, but their seasonal presence was in 2023 and 2024.

The anglers reported substantial economic damage caused by cormorants to their fish. In 2024, the 15 departments reported a total amount of about EUR 4.6 million in damages, with the largest reported departmental costs in Lot-et-Garonne (EUR 1.45 million), Vienne (EUR 645 000), Eure-et-Loir (EUR 563 000) and Savoie (EUR 551 000). These amounts include direct and indirect costs, such as restocking, monitoring, deterrence and lost angling value. Most of the costs relate to the extra stocking that the angling clubs must do to compensate for the predation pressure from the cormorants. Making waters attractive for fishing, ensuring a healthy aquatic biodiversity, rehabilitating near depleted stocks, and bringing back indigenous species are costly endeavours.

The total damage reported by the 15 departmental federations in 2024 was higher than in 2023, when the same departmental federations reported EUR 3.8 million in cormorant-related damages.

The increasing damage reported is a result of rising cormorant populations (according to their own counts), and the substantial increase in the price of fish used for stocking in France, which broadly also follows the trends observed in the aquaculture sector. Based on available price lists from fish hatcheries and nurseries in France, the increase in fingerling and juvenile fish prices for stocking in the period 2021–2024 was approximately 25–35 percent on average. This included lower increases for cyprinids (15–30 percent) and higher increases for salmonids and predatory species such as pike and zander (25–45 percent) (Agreste, 2023, 2025). The prices for stocking two- or three-summer-old juvenile carps in 2023/2024 were generally higher than EUR 4.50/kg, trout was about EUR 6/kg, and perch was more than EUR 12/kg; the prices for two- or three-summer-old sander (pike-perch) were over 20 EUR/kg. In 2025, some angling clubs reported that the average prices of commercially valuable fish species for stocking their waters were above EUR 8/kg.

Across the 15 departments, respondents attributed most fish damage to cormorants, usually 75–99 percent, with an average close to 80 percent when percentages were given. The fish species most often identified as threatened are the brown trout, grayling, eel and pike, with some concern also for the large predation pressure of cormorants on cyprinids and other indigenous and migratory species (e.g. allis shad, twaite shad, and sea and river lamprey).

Assuming that the information received from the 15 departmental federations is representative for the predation situation across France (94 departmental federations), a rough estimate of the total annual damage caused by cormorants to fish stocks that are managed or owned by angling clubs in France would be EUR 27.6 million.

Box: Example of how cormorant predation of fish impacts recreational fishing interests

In 2025, the Fédération de la Charente-Maritime pour la Pêche et la Protection du Milieu Aquatique (FD 17) prepared a detailed overview of the damages caused by cormorant predation to justify a request to the prefecture to cull some cormorants at their fishing sites. The information included species composition, fish biomass, cormorant numbers predating, and fish biomass losses at each site. The nine angling sites concerned were natural ponds, small lakes and reservoirs for recreational angling with a combined water surface of 42.75 ha (on average 4.75 ha) and a total fish biomass of 20.28 tonnes (2.25 tonnes on average). The predation pressure was caused by a total of 191 cormorants, and the number of days they were active at the sites was, on average, 75 days. In one year, cormorants killed an estimated 28 percent of the fish at the nine sites. The species distribution (consisting of a mix of pike, eel, perch, roach, rudd, tench, common carp, common bream and silver bream) at the sites was known by percentage, and the predation pressure could be measured for each species. Moreover, the Fédération had the market prices from the hatcheries in the department. The value of fish lost to cormorant predation at the nine sites was estimated (with high confidence levels). It amounted to EUR 45 500, which is an economic loss of EUR 1 064/ha of water surface.

Reported cormorant damage to aquaculture production in France

The total surface area of fish ponds in France is estimated at approximately 112 000 ha, based on Agreste-derived statistics and national reports (AFPPE, n.d; Haut-commissariat au Plan, 2023). An estimated 61 percent (±68 000 ha) of this pond area is actively used for aquaculture production, with the remainder dedicated to recreational fisheries or partially managed systems (MedWet, 2014).

In 2010, cormorant predation (under moderate bird pressure) caused fish losses of EUR 150–250/ha per year to pond farmers in France. A multiregional study showed that, on average, cormorant predation impact on pond fish production led to 10–15 percent turnover reductions and cost the pond farmers up to EUR 10 000 per farm annually. At broader scale, losses reached approximately 10 percent of total freshwater aquaculture turnover and up to 20–80 percent in pond systems (Bobbé, 2010). Since then, cormorant predation pressure further increased. Another detailed study covered the period 2018–2020 for a 40 ha pond farm, which cultured a mix of freshwater pond species. The farm experienced a decline in turnover from EUR 56 600 to EUR 44 400 between 2018 and 2020, representing a decrease of about 22 percent. The average losses per hectare of pond area were more than EUR 300/ha per year. The study indicated that cormorant predation was the primary driver of reduced fish production, implying a substantial erosion of profitability, eliminating net profit margins that are typical of extensive pond aquaculture systems (Parlier, 2024). Other studies reported an average loss of income for pond farmers in 2018, ranging from EUR 2 700 to 4 000 per hectare depending on the farmer (Mérillou, 2024).

More than 50 aquaculture farmers of freshwater ponds and raceway culture/recirculation systems provided production and loss data on their production of trout, carp and mixed freshwater species for this inventory.

In 2023, approximately 270 commercial trout farmers produced 29 300 tonnes of fish at an off-farm value of EUR 151 million; the average off-farm value was 5.16/kg (Agreste, 2025). The average off-farm value per farm was EUR 560 000 in 2023.

Thirty trout farmers from various regions, including Normandie, Haut-De-France, Occitanie, Nouvelle-Aquitaine and Bretagne, reported on their production area, which ranged from 2 000 m^3 to 8 000 m^3 of raceway systems or recirculation systems. The farms with recirculation systems reported zero to 1 percent of losses due to predation by cormorants. Farmers with raceway/flow-through systems reported losses of generally 2–10 percent. Fifteen farms calculated the value of predation losses caused by cormorants in 2024 and reported an average of more than EUR 23 000 in income losses, which represents approximately 4 percent of their off-farm fish value. The dataset, comprising 30 trout farms, is assumed to be indicative of the prevailing production systems and economic conditions within the sector. While not exhaustive, the sample provides a reasonable basis for extrapolation. The derived indicators can therefore be scaled up using the total number of trout farms (270) to provide a national-level indicative estimate of damage caused by cormorants to trout farming in France of more than EUR 6 million/year.

Four pond farmers with trout production in small ponds up to 0.4 ha reported 5–10 percent production losses owing to cormorant predation, in addition to about 5 percent of damaged fish. Their reported annual income losses were highly diverse (EUR 1 000–75 000), which may be related to the market values used, as fish for put-and-take trout fisheries fetch much higher prices than off-farm fish for consumption. Although the information received was incomplete, it largely confirmed the above information on economic losses caused by cormorant predation as reported from other trout farms.

Thirteen pond culture farmers, with a combined pond area of 1 345 ha and an average production of 308 tonnes (240 kg/ha/year) in recent years, reported cormorant predation losses of 10–40 percent, with an average of 31 percent and around 17 percent of damaged fish. They estimated their farm income loss from cormorant predation at EUR 545 000 in 2024, which is, on average, nearly EUR 42 000 per farm. The income loss per hectare was EUR 405/ha.

An example of cormorant predation pressure on a fish farm in France. © Fédération Française d'Aquaculture

The findings from the sample of 13 pond farms, historical damage estimates from previous studies (Bobbé, 2010; Parlier, 2024; Mérillou, 2024), combined with increased predation, inflation and rising off-farm, off-hatchery and consumer fish prices, indicate that average fish predation losses of freshwater pond farmers were, in 2024–2025, generally in the range of EUR 350–400/ha per year. Applying these figures to the national aquaculture pond area of approximately 68 000 ha provides an indicative estimate of total freshwater pond aquaculture sector-level losses due to cormorant predation in the range of EUR 23.8–27.2 million per year in France. The extrapolation assumes similar levels of predation pressure and production characteristics across freshwater pond farming systems.

Various freshwater pond farmers also reported predation damage from herons. While predation by herons was substantial for a few farms, it generally accounted for 2 percent or less of the total damage caused by fish predators.

Information was also received from one 7.5 ha seawater aquaculture farm culturing seabass and seabream in the region of Occitanie. Annually, the intensive fish farm produces 1 100 tonnes of fish in tanks, cages and ponds. The farm reported a historical average return (survival) rate of 88 percent over the past 15 years. However, for the 2024 production cycle, assessed in 2025, the return rate declined to 64 percent, corresponding to a shortfall of approximately 360 000 fish. The hundreds of cormorants predating on the fish in the ponds were the main cause of the production shortfall. Based on an average market weight of 550 g per fish, this represents a production loss of about 198 tonnes. At an average sales price of EUR 9.10–9.64 per kilogram, the resulting loss in turnover was estimated at approximately EUR 1.8 million.

Freshwater pond and trout raceway farmers also reported on the expenses incurred to prevent damage from cormorants and other fish-eating birds. Farms purchased nets to cover raceways and tanks, often adding up to thousands of euros of costs. Nets were the main items purchased. They last several years but require annual repairs and partial replacements. Bird scaring gas cannons were also frequently used. Many pond farmers also invested in nets to cover their smaller ponds and tanks. Other costs were for lines, bird-scaring balloons, gas cannons, ammunition, and some farmers also purchased electric fences to deter herons. The total costs for preventive measures varied substantially between farms.

In addition, some farmers reported experiencing stress from constantly monitoring their ponds to reduce fish predation by cormorants. They often have multiple predation prevention interventions daily, which are particularly intense during the winter. They organize regular patrols with shooting and scaring actions. Although quantitative data are scarce on the working time spent on preventive measures, these activities represent a significant labour burden and may correspond to a substantial share of the annual working time on affected fish farms.

In early 2025, greater clarity was obtained on the scaring and culling of cormorants affecting fish farms in France. It came through a ministerial order: “Order of 24 February 2025 laying down the conditions and limits under which derogations from the prohibition of disturbance and destruction of great cormorants (*Phalacrocorax carbo sinensis*) may be granted by prefects” (France, 2025).

The ministerial order establishes the legal framework governing derogations allowing the control (disturbance or shooting) of great cormorants in France. While the species remains protected, prefects may authorize measures to prevent significant damage to fish farms and impacts on threatened fish populations. The order defines eligible beneficiaries, including fish farmers and authorized personnel, and specifies operational conditions such as locations, periods and methods. Scaring techniques (visual or acoustic disturbance) are permitted alongside regulated shooting, which is restricted to daytime and subject to strict controls to minimize impacts on other protected species. The decree aims to balance species protection with aquaculture and fisheries interests. As the order was recently issued, no information is available on its application and impact yet.

Farmer organizations also reported on several fish farms that had closed owing to excessive predation. For instance, Pisciculture Couturier, Pouligny-Saint-Pierre, closed in 2017. The farmer experienced significant and recurrent losses of fish stocks because of the large numbers (300 to 800) of cormorants feeding on its 30 ha ponds and 8 ha of basins, reducing harvestable biomass and undermining profitability. Annual turnover without predation pressure would have been around EUR 60 000–80 000 per year. Despite mitigation efforts, predation pressure remained too high to sustain production. These losses, combined with low margins in extensive pond aquaculture, contributed to the decision to cease operations (France Bleu, 2017).

According to Étangs de France, at least three trout farms in the Normandy and Grand-Est regions closed between 2015 and 2024 because of cormorant predation or a combination of predation and other causes. The three farms had a combined water surface area of 11 000 m^2 and an average annual trout production of more than 400 tonnes. The annual off-farm income from fish sales for these three farms was around EUR 2 million.

Another recent closure, in 2024, was Escalon Distribution, a pond farm of freshwater fish in Boen-Sur-Lignon, whose closure can be partly attributed to predation by cormorants. It was reported that this farm had hundreds of hectares of ponds for freshwater fish culture, with an annual production of around 300 tonnes and a turnover of EUR 1 million per year.

Various fish farmers reported that other fish farms were not acquired upon the retirement of the farmer because predation pressure would not make the farms economically viable. Some small fish farms closed, with farmers disclosing that bird and cormorant predation was one of the main reasons; other farmers diversified into other businesses to make a living. Many professional pond fish farmers have diversified their farms into other activities, such as put-and-take fishing, processing and reselling equipment for ornamental fish, or have taken jobs outside fish farming.

These cases illustrate how persistent cormorant predation can directly affect farm viability and accelerate the abandonment of traditional pond aquaculture systems in France.

References

Agreste. 2023. *Aquaculture en France en 2021. Résultats de l'enquête 2022.* Chiffres et données – Agriculture No. 2023-8. Paris, France, Ministère de l'Agriculture et de la Souveraineté alimentaire. 72 pp. https://agreste.agriculture.gouv.fr/agreste-web/download/publication/publie/Chd2308/cd2023-8_Aqua2021.pdf

Agreste. 2025. *Aquaculture en France en 2023. Résultats de l'enquête 2024.* Chiffres et données – Agriculture. Paris, France, Ministère de l'Agriculture et de la Souveraineté alimentaire. https://www.agreste.agriculture.gouv.fr/agreste-web/download/publication/publie/Chd2506/cd2025-6_Aqua2023.pdf

AFPPE (Association Française des Professionnels de la Pisciculture d'Étangs). n.d. *La pisciculture en étang – un métier au service de la biodiversité*.

Bobbé, S. 2010. *Impacts des grands cormorans sur les activités piscicoles et les milieux qui en dépendent (Impacts cormorans et pisciculture en France).* Paris, France, Institut technique de l'aviculture/Service technique aquaculture. 95 pp. https://side.developpement-durable.gouv.fr/Default/doc/SYRACUSE/215203/etude-des-impacts-de-la-population-de-grands-cormorans-sur-les-activites-piscicoles-et-les-milieux-q?_lg=fr-FR

FNPF (Fédération Nationale de la Pêche en France). 2026. *Associations Agréées de Pêche et de Protection du Milieu Aquatique (AAPPMA)*. Paris, France. https://www.federationpeche.fr/118-aappma.htm

France. 2025. Arrêté du 24 février 2025 fixant les conditions et limites dans lesquelles des dérogations aux interdictions de destruction et de perturbation des grands cormorans *(Phalacrocorax carbo sinensis)* peuvent être accordées par les préfets. *Journal officiel de la République française, JORFTEXT000051249781*. Paris. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000051249781

France Bleu. 2017. *Dans la Brenne, une pisciculture emblématique ferme ses portes.* France Bleu. https://www.francebleu.fr/infos/agriculture-peche/dans-la-brenne-une-pisciculture-emblematique-ferme-ses-portes-1491734

Haut-commissariat au Plan. 2023. *Le développement de l'aquaculture: un enjeu de souveraineté alimentaire.* Paris, France, Gouvernement français. https://www.info.gouv.fr/upload/media/content/0001/09/19885ad84978486e59b2daed03ae2f113e29954c.pdf

Marion, L. 2021. *Recensement national des grands cormorans nicheurs en France en 2021*. Rennes, France, Ministère de la Transition écologique, Direction de l'eau et de la biodiversité/ SESLG–Université Rennes, 1–CNRS–MNHN. 27 pp. https://oiseaux-marins.org/upload/iedit/1/pj/706_2439_2024_Rapport_Recensement_national_grands_cormorans_nicheurs_2024.pdf

Marion, L. 2022. *Recensement national des grands cormorans hivernant en France durant l'hiver 2020–2021. Rapport final (bilan corrigé au 28 février 2022).* Rennes, France, Ministère de la Transition écologique, Direction de l'eau et de la biodiversité/SESLG–Université Rennes, 1–CNRS. 53 pp. https://www.consultations-publiques.developpement-durable.gouv.fr/IMG/pdf/4_-_2021_rapport_recens_cormhiv_definitif.pdf

Marion, L. 2024. *Recensement national des grands cormorans nicheurs en France en 2024.* Rennes, France, Ministère de la Transition écologique et de la Cohésion des territoires, Direction de l'eau et de la biodiversité/SESLG–Université Rennes, CNRS. 28 pp.

Marion, L. 2025. *Recensement national des grands cormorans hivernant en France durant l'hiver 2023–2024. Rapport final (bilan au 5 mars 2025).* Rennes, France, Ministère de la Transition écologique, Direction générale de l'aménagement, du logement et de la nature, Direction de l'eau et de la biodiversité/SESLG–Université Rennes 1, CNRS. 54 pp.

MedWet (Observatoire des zones humides méditerranéennes, OZHM). 2014. *Agriculture, aquaculture et milieux humides en France: les chiffres clés.* Arles, France, Tour du Valat/ MedWet Initiative. https://medwet.org/wp-content/uploads/2014/09/140731_publication_omh_agriculture_et_milieux_humides.pdf

Mérillou, S. 2024. *Impact de la prédation du grand cormoran sur les populations de poissons.* Question écrite n°00442, Sénat, France. Publiée le 3 octobre 2024, réponse publiée le 29 mai 2025. Paris. https://www.senat.fr/questions/base/2024/qSEQ241000442.html

Parlier, E. 2024. *Rapport d'expertise: EARL de la Belle Étoile c/ Préfet des Deux-Sèvres (Affaire n°2003126).* La Roche-sur-Yon, France, Parlier Environnement SAS. 93 pp.

Germany

Information was obtained from the German Angling Association (Deutscher Angelfischerverband e.V.), its member angling clubs, and fish farmer members of the Association of German Inland Fisheries and Aquaculture (Verband der Deutschen Binnenfischerei und Aquakultur e.V.). The information was cross-checked with scientific studies and sectoral reports from public institutions in Germany.

Germany's official reporting under Article 12 of the EU Birds Directive (2013–2018 reporting cycle) indicates a breeding population of approximately 19 000–23 000 pairs of great cormorants, with a stable trend. While updated data for the 2019–2024 reporting cycle have been submitted, no consolidated national-level publication is yet available. At the federal level, no dedicated cormorant report exists. In Germany, detailed information on the great cormorant is therefore provided primarily through state-level (Länder) reports rather than national publications. The most comprehensive reports are produced in northern and eastern federal states, particularly Mecklenburg–Western Pomerania (also known as Mecklenburg-Vorpommern), which hosts approximately 50–60 percent of the national breeding population. These reports typically include long-term population trends, winter counts and assessments of impacts on fisheries, forming the primary evidence base for management decisions.

The 2025 Kormoranbericht Mecklenburg-Vorpommern reports and earlier editions, published by the Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern, provide an overview of population development, wintering numbers and management of the great cormorant in the federal state of Mecklenburg-Vorpommern. In 2025, the state's breeding population reached 12 204 breeding pairs across 23 colonies, representing a moderate increase compared with 10 205 breeding pairs in 2024. The increase reflects typical annual fluctuations and the redistribution among colonies, including the establishment of new coastal breeding sites and the reoccupation of inland colonies.

At the national level, Germany recorded approximately 22 230 breeding pairs in 2024, with Mecklenburg-Vorpommern accounting for about half of the total population. Wintering numbers increased strongly, with 34 126 individuals recorded during the January 2025 midwinter census, representing the highest value in the long-term monitoring series. This increase is attributed to mild winter conditions, which reduce mortality and limit southward migration. Long-term trends indicate that, following rapid population growth since the 1980s, the cormorant population has stabilized at a high level, with interannual variability driven by climatic conditions and colony dynamics. The 2025 report also highlights a shift towards shorter migration distances, with a growing proportion of birds remaining closer to breeding areas during winter.

The 2023 and 2024 Kormoranbericht Mecklenburg-Vorpommern reports (Herrmann, 2025, 2026) estimate the number of breeding pairs in Germany at 24 517 pairs in 2023, declining to about 22 230 pairs in 2024, according to J. Kieckbusch (VSW SH). The corresponding numbers of breeding cormorants, at approximately 49 034 and 44 460 individuals in 2023 and 2024, respectively, do not include offspring (for example, one- and two-year-old immature birds), failed breeders and old birds (Table). Germany also functions as a major staging and redistribution zone, and the migration of thousands of cormorants each spring and autumn adds to the numbers counted. Migration lasts approximately 90–120 days in autumn and 30–60 days in spring. Consequently, the combined damage estimates of EUR 25.3 million in 2023 and EUR 25.8 million in 2024 may represent a significant underestimation.

Table. Estimated damage caused to fish in Germany, based on breeding pair and midwinter roosting population counts in Mecklenburg-Vorpommern and average fish prices

	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)**	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant breeding population	49 034 (= pairs × 2)	44 460	150	18 388 000	16 673 000
Non-breeding population (wintering)*	31 334	41 024	90	7 050 000	9 230 000

*To estimate the non-breeding population, the midwinter roosting population count in Mecklenburg-Vorpommern (15 667 individuals in January 2023 and 20 512 individuals in January 2024) was used and multiplied by two to obtain a general estimate for Germany.

** The number of days of occurrence of breeding and wintering cormorants may be underestimated, as a breeding season of 150–180 days is common and differences among scientific publications are large (for example, Herrmann and Zimmerman, 2019; Herrmann *et al*., 2021; Keller, Bregnballe and Eerden, 2019).

Based on these estimates, the number of cormorant days would exceed 10 million per year. With an average fish consumption rate of 0.5 kg/day, the total estimated fish consumption by cormorants in Germany is at least 5 100 tonnes per year. This is equivalent to about 14 tonnes of fish consumed daily by the cormorant population in Germany.

The Deutscher Angelfischerverband represents about 9 000 angling clubs, and the combined number of anglers in these clubs exceeds 500 000 (DAFV, 2026). The total number of valid angling licences in Germany in 2024 was 1 788 307 (Brämick and Schiewe, 2025).

The Deutscher Angelfischerverband invited its members to respond to a survey by the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), European Anglers Alliance (EAA) and Federation of European Aquaculture Producers (FEAP) on cormorants in 2025 and collected responses from 49 angling clubs across Germany. Angling clubs are the main leaseholders and managers of inland waters in Germany. Together, these 49 angling clubs manage 11 370 ha of rivers, lakes and ponds. The average area managed per club in 2023/2024 was 316 ha. The angling clubs reported cormorant predation on roach, perch, eel, zander (pike-perch), brown trout, rainbow trout, grayling, coregonids, barbel, rudd, tench and pike. Some respondents noted impacts on all local species except catfish. Most angling clubs attributed 75–100 percent of their fish-stock losses to predation by cormorants, and some clubs specifically reported that middle age-groups of fish were the main target. Clubs also reported that whitefish (coregonids) and grayling stocks have been depleted over the years because of cormorant predation.

Other predators reported were otters, herons, goosanders and great crested grebes, but the reported contribution of these predators to total predation impacts on fish was generally only a few percent.

The estimated costs reported by the 49 angling clubs for additional restocking, scaring and monitoring, and for building shelters or refuges for fish to reduce predation by cormorants, amounted to just over EUR 1 million in 2023 and EUR 1.2 million in 2024. Average costs per angling club were estimated at EUR 31 000 in 2023 and EUR 37 000 in 2024. In 2023/2024, the average cost related to cormorant predation was EUR 97/ha.

There are approximately 825 000 ha of inland waters in Germany. Commercial inland fisheries are practised on about 226 000 ha. In 2024, German angling clubs owned or leased more than 275 000 ha of water (Brämick and Schiewe, 2025).

Multiplying the loss-of-yield information from the angling clubs (EUR 97/ha) by 275 000 ha suggests that the total damage caused by cormorants to Germany's inland recreational fishery resources is around EUR 27 million.

Brämick and Schiewe (2024) reported that Schleswig-Holstein, the northernmost state in the country, calculates an annual loss-of-yield value for cormorant damage in its inland fisheries. Since 2022, this has amounted to EUR 57 per hectare of water surface and serves as the basis for applying for compensation payments for yield losses. The report also noted that a directive came into force in Schleswig-Holstein in 2023, which allows commercial inland fishery enterprises to receive compensation for yield losses within the framework of funding from the European Maritime, Fisheries and Aquaculture Fund. In return, cormorant hunting on inland waters is waived, except at aquaculture facilities and for limited periods following eel stocking.

Additionally, Brämick and Schiewe (2024, 2025) collected information on federal and state government spending on prevention of, and compensation for, damage caused by wildlife to inland fish resources in Germany. Total government expenditure was EUR 5.24 million in 2024, similar to the level recorded in 2023. Given the prominence accorded in the report to cormorant-related damage to fish stocks, the negative effects of cormorants on fish-species conservation projects (including eel, trout and whitefish species) and the statement that cormorants are the central conflict species in inland fisheries, it can be inferred that most of the expenses were incurred to prevent and compensate for cormorant damage. The same report noted that approximately 20 000 cormorants were hunted in the country during the 2023/2024 hunting season, but also observed that problems of fish predation by cormorants persist.

Germany has about 20 735 ha of actively used aquaculture ponds, while the total pond area, including extensive, semi-active or marginal ponds, is around 40 000 ha (Brämick and Schiewe, 2025; FAO, 2026). Raceway culture volume, used mainly for trout farming, is about 2 700 m^3.

Seven pond fish farmers, producing carp, pike-perch, tench and trout in five federal states, reported that cormorant predation affected their income in 2023 and 2024. The total pond area covered by these farms was 2 587 ha, with an average pond area of 370 ha. The smallest farm had 6 ha, while the largest had nearly 900 ha of ponds. Reported losses and damages ranged from 10 percent to 30 percent of fish killed and up to 25 percent of fish damaged. The seven farms together produce, on average, more than 1 300 tonnes annually on 2 587 ha, equivalent to around 500 kg/ha. Estimated income losses reported by the farmers ranged from EUR 31 000 to EUR 200 000 per year, averaging EUR 115 000. The total income loss reported by the seven farms for 2024 was EUR 803 000. Extrapolated to the pond-farming sector as a whole (20 735 ha), this suggests an indicative income loss of around EUR 6.4 million caused by cormorant predation.

The seven farms also reported the costs of preventive and mitigating activities related to cormorant predation. Total costs estimated by these farmers were EUR 185 000 in 2023, with an average of EUR 26 000, and EUR 188 000 in 2024, averaging about EUR 28 000. The average cost per hectare, mainly for prevention, scaring, acoustic and optical deterrence, hunting and netting, was about EUR 72/ha.

Assuming uniform costs, these expenses can be extrapolated to the total pond-farming area of 20 735 ha in Germany. This provides a rough estimate of EUR 1.5 million in annual expenditure by pond farmers on the prevention and mitigation of cormorant damage to fish stocks. However, losses and damage to cultured fish are not included in this figure.

In conclusion, the annual damage caused by cormorants to Germany's inland fish stocks, fisheries and aquaculture exceeds EUR 35 million. This estimate does not include the damage caused to coastal marine fish stocks and fisheries.

References

Brämick, U. & Schiewe, S. 2024. *Jahresbericht zur Deutschen Binnenfischerei und Binnenaquakultur 2023*. Institut für Binnenfischerei e.V., Potsdam-Sacrow. https://www.portal-fischerei.de/fileadmin/SITE_MASTER/content/Dokumente/Bund/Jahresbericht_Binnenfischerei_Berichtsjahr_2023_korrigiert.pdf

Brämick, U. & Schiewe, S. 2025. *Jahresbericht zur Deutschen Binnenfischerei und Binnenaquakultur 2024*. Institut für Binnenfischerei e.V., Potsdam-Sacrow. https://www.ifb-potsdam.de/veroeffentlichungsdatenbank/ansicht/17245/jahresbericht-zur-deutschen-binnenfischerei-und-binnenaquakultur-2024.html

DAFV (Deutscher Angelfischerverband). 2026. *Organisation and membership structure*. Berlin. https://www.dafv.de

FAO. 2026. Fishery and Aquaculture Country Profiles. Germany, 2024. Country Profile Fact Sheets. In: *Fisheries and Aquaculture*. Rome. https://www.fao.org/fishery/en/facp/deu

Herrmann, C. 2026. *Kormoranbericht Mecklenburg-Vorpommern 2025*. Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern (LUNG), Güstrow, Germany. https://www.lung.mv-regierung.de/static/LUNG/Inhalte/Seiten/Fachinformation/Natur%20und%20Landschaft/kormoranbericht_mv_2025.pdf

Herrmann, C. 2025. *Kormoranbericht Mecklenburg-Vorpommern 2024*. Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern (LUNG), Güstrow, Germany. https://www.lung.mv-regierung.de/static/LUNG/dateien/fachinformationen/natur/kormoranbericht_mv_2024.pdf

Herrmann, C., Feige, K.-D., Otto, D. & Bregnballe, T. 2021. Natural regulation of the Baltic population of the great cormorant *Phalacrocorax carbo sinensis*: the interplay between winter severity and density dependence. *Ardea*, 109(3): 341–352. https://doi.org/10.5253/arde.v109i2.a7

Herrmann, C. & Zimmermann, H. 2019. Kormoran Phalacrocorax carbo. In: *Beiträge zur Avifauna Mecklenburg-Vorpommerns, Heft 3*, 23–68. Ornithologische Arbeitsgemeinschaft Mecklenburg-Vorpommern e.V. (OAMV), Germany.

Keller, T., Bregnballe, T. & van Eerden, M.R. 2019. Phalacrocorax carbo – *migration and population ecology in Central Europe*. Report prepared within the INTERCAFE/European cormorant research network. University of Natural Resources and Life Sciences (BOKU), Vienna, Austria.

Greece

Information was received from the Forest Research Institute (Hellenic Agricultural Organization "DIMITRA") through the Directorate General of Fisheries of the Ministry of Rural Development and Food.

The Table presents the estimates of damages caused by fish predators, based on data from the Forest Research Institute. In both 2023 and 2024, the institute estimated the number of breeding great cormorants at approximately 20 000 individuals. The non-breeding (wintering) population was estimated at 43 500 individuals in 2023 and 40 000 individuals in 2024 (Table).

Table. Estimated damage caused by fish predators in Greece

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	20 000	20 000	150	7 500 000	7 500 000
Great cormorant	Non-breeding population	43 500	40 000	215	23 400 000	21 500 000
Pygmy cormorant	–	750	750	365	6 160 000	6 160 000
Heron	–	12 200	12 200	150	1 750 000	1 750 000

The large size of the wintering population is consistent with earlier findings. In 2013, Kazantzidis *et al*. (2017) recorded 43 537 great cormorants at 34 roosting sites. The breeding population has continued to increase since 2012, when 6 978 breeding pairs were recorded (Kazantzidis, 2014), and 9 256 breeding pairs were counted in 2014. The annual increase in breeding pairs between 1988 and 2014 was estimated at +26.5% ± 0.05 (SD) (Kazantzidis *et al*., 2021).

The increase has been attributed to factors such as the availability of fish in coastal waters, wetland protection measures and reduced disturbance. However, marine fish production has declined, with annual landings decreasing from approximately 150 000 tonnes in the mid-1990s to around 65 000 tonnes in recent years (FAO, 2026).

This trend suggests that cormorants are increasingly targeting aquaculture, which has expanded from 32 000 tonnes in 1995 to more than 140 000 tonnes in 2023 (FAO, 2026). Aquaculture production consists largely of seabass and gilthead seabream in marine cages. Land-based nurseries and semi-extensive lagoon systems, however, remain particularly vulnerable to predation. In Porto Lagos Lagoon/Lake Vistonis (Vistonida), the Amvrakikos Gulf and coastal lagoons in Thrace, several aquaculture and fisheries enterprises have ceased operations because of the intense predation pressure (Panagiotopoulou, Kazantzidis and Koutrakis, 2011; Katselis, Konstas and Moutopoulos, 2023).

Fisheries in the lagoons of the Amvrakikos Gulf are particularly affected by wintering cormorants. Annual fish biomass losses reduce production and cause significant income losses, particularly for gilthead seabream and mugilids.

In the period 2011–2020, the average annual income losses across 14 lagoons were estimated at EUR 240 000, with maximum losses reaching EUR 700 000 (Katselis, Konstas and Moutopoulos, 2023).

The Forest Research Institute estimated that breeding and wintering cormorants together consume approximately 5 800–6 000 tonnes of fish annually. This level of predation constrains aquaculture development and reduces the economic viability of coastal and lagoon fisheries.

No compensation was paid by the government to fishers or fish farmers for losses caused by cormorants in 2023 and 2024.

References

FAO. 2026. Fishery and Aquaculture Country Profiles: Greece. 2024. In: *Fisheries and Aquaculture*. [Cited 21 April 2026]. Rome. https://www.fao.org/fishery/en/facp/GRC

Katselis, G., Konstas, S. & Moutopoulos, D.K. 2023. Estimation of fishery losses from great cormorants during the wintering period in Greek lagoons (Ionian Sea, western Greece). *Sustainability*, 15: 12007. [Cited 21 April 2026]. https://www.mdpi.com/2071-1050/15/15/12007

Kazantzidis, S. 2014. Status of the breeding population of great cormorants in Greece in 2012. In: *Breeding numbers of great cormorants in the Western Palearctic*, 2012–2013. Aarhus University. [Cited 21 April 2026]. http://dce2.au.dk/pub/SR99.pdf

Kazantzidis, S., Naziridis, T., Bourdakis, E. & Vasiliadis, I. 2017. *Numbers, distribution and roosting site characteristics of wintering great cormorants in Greece (2013)*. Conference proceedings.

Kazantzidis, S., Naziridis, T., Catsadorakis, G., Nikolaou, H. & Makrigianni, E. 2021. Status and population trends of great cormorants breeding in Greece. *Ardea*, 109: 367–380.

Panagiotopoulou, M., Kazantzidis, S. & Koutrakis, E. 2011. Cormorants–fisheries conflict: the case of Porto Lagos lagoon, north-east Greece. [Cited 21 April 2026]. https://www.researchgate.net/publication/262856464

Hungary

Information was received from the Hungarian National Fishing Association (Magyar Országos Horgász Szövetség), which compiled data from its member angling clubs and from pond fish farmers of the Hungarian Aquaculture and Fisheries Inter-Branch Organisation (MA-HAL). The MA-HAL data covered approximately 33 percent (8 818 hectares) of the total aquaculture pond area in Hungary (26 836 hectares).

The data in the Table provide aggregate estimates of cormorant-related damage to pond aquaculture in Hungary, which is dominated by common carp production.

The total estimated damage caused by cormorants to pond fish production was EUR 6.8 million in 2023 and EUR 7.2 million in 2024. The reporting farmers received EUR 10 000 in compensation in 2023 and EUR 14 000 in 2024. Culling of cormorants is generally permitted. In nature-protected areas and NATURA 2000 sites, this activity requires a permit. However, in other areas, culling may be carried out between 1 September and 31 January without a special permit from the authorities. More than 10 000 birds have been culled annually in recent years.

Table. Aggregate estimates from Hungarian pond fish farms for the number of cormorants and damage

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	1 730	1 730	180	622 000	607 000
Great cormorant	Non-breeding population	8 455	9 306	365	6 172 000	6 624 000

Note: Official average annual exchange rates were applied for conversion from the Hungarian forint (HUF) to EUR.

The MA-HAL fish farmers reported that 13.8 percent of their fish were killed by cormorants and an additional 9.7 percent of harvested fish showed signs of damage. The average income loss due to predation was estimated at 10.4 percent.

In 2024, Hungarian pond farms produced 22 838 tonnes of fish, with a farm-gate value of EUR 50.3 million (Eurofish, 2026). The reported losses are consistent with this scale of production.

Farmers also reported costs incurred to prevent predation. The costs amounted to EUR 331 000 in 2023 and EUR 366 000 in 2024. Labour costs for watchkeeping and bird scaring represented approximately 75 percent of total prevention costs. Additional expenditures included approximately EUR 35 000 annually for ammunition, more than EUR 40 000 for fuel, and approximately EUR 4 500 for gas cannons.

The Hungarian National Fishing Association estimated that 60 percent of predation in managed waters is caused by cormorants. The remaining 40 percent is attributed to otters (*Lutra lutra*) and other fish-eating birds, including the great egret (*Egretta alba*), little egret (*Egretta garzetta*), black-crowned night heron (*Nycticorax nycticorax*) and pygmy cormorant (*Phalacrocorax pygmeus*).

Fish species subject to significant predation pressure include several protected and strictly protected species: zingel (*Zingel zingel*), Danube streber (*Zingel streber*), yellow pope (*Gymnocephalus schraetser*), gudgeon species (*Gobio* spp., *Romanogobio* spp.) and sterlet (Acipenser ruthenus).

Predation also affects species with high economic importance: pike-perch (*Sander lucioperca*), Volga pike-perch (*Sander volgensis*), perch (*Perca fluviatilis*), European catfish (*Silurus glanis*), northern pike (*Esox lucius*), barbel (*Barbus barbus*), bream (*Abramis brama*) and burbot (*Lota lota*).

The total value of fish consumed by cormorants in natural waters is not precisely known but is high. No compensation scheme exists for angling clubs to offset stocking losses caused by predation.

BirdLife International (2021) estimated 2 300–2 800 breeding pairs and up to 10 000 wintering birds in Hungary (2013–2017); however, these figures may underestimate current populations. Based on these values, annual consumption would be approximately 2 300 tonnes of fish, corresponding to a value of nearly EUR 9 million.

Using more recent estimates from the Hungarian National Fishing Association of approximately 30 000 non-breeding birds, total annual fish consumption may reach 5 500 tonnes, corresponding to an estimated value of more than EUR 26 million.

References

BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union.

Eurofish. 2026. Hungary. By J. Dohmen. In: *Country profile*. [Cited 21 April 2026]. https://eurofish.dk/member-countries/hungary

Latvia

Information was received from the Latvian Nature Conservation Agency through the Institute of Food Safety, Animal Health and Environment (BIOR).

The Nature Conservation Agency estimated the number of breeding pairs of great cormorants in recent years at 2 634–3 106 pairs, with an increasing trend. Earlier estimates by BirdLife International (2021) reported 2 300–3 500 breeding pairs. Comprehensive data on migratory or wintering cormorants do not exist because systematic monitoring is not conducted. However, large numbers of migratory and wintering birds are known to occur, particularly in coastal areas.

The estimated number of breeding individuals is approximately 6 000 birds in 2024 (Table). This estimate excludes immature birds, failed breeders and older non-breeding individuals. The total number of great cormorants feeding in Latvian inland and coastal waters during summer is estimated at between 9 000 and 15 000 individuals.

The number of heron breeding pairs was estimated at 1 100–2 000, while the otter population was estimated at 3 000–4 000 individuals in 2023 and 2024.

Table. Estimated damage caused to fish based on breeding pair counts in Latvia

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	5 268	6 212	180	2 300 000	2 800 000
Great cormorant	Non-breeding population	Unknown	Unknown	–	–	–

Source: Latvian Nature Conservation Agency.

In 2023, more than EUR 105 000 in compensation was paid to fish farmers for damage caused by cormorants. In 2024, compensation rose to nearly EUR 140 000, indicating an upward trend in claims. Compensation is provided at 80 percent for damages caused by migratory and protected species, in accordance with national legislation (Latvia, 2007).

Compensation for damage caused by herons amounted to approximately EUR 48 000 in 2023 and EUR 55 000 in 2024. Compensation for damage caused by otters was significantly higher, at EUR 568 000 in 2023 and EUR 548 000 in 2024.

The total value of fish consumed by otters in Latvia was estimated at approximately EUR 6.8 million per year. Predation by herons on fish stocks was estimated at around EUR 543 000 annually in 2023 and 2024.

In 2024, 545 cormorants were culled under 14 permits, which allowed for the culling of up to 820 birds. This represents an increase from 2023, when 250 cormorants were culled under nine permits.

In recent years, while the number of aquaculture ponds has decreased, their average size has increased. An increasing number of farmers are transitioning to recirculation aquaculture systems, where production conditions can be better controlled and predation by cormorants is not an issue.

Total aquaculture production in 2024 was 742 tonnes. The main species cultured were common carp (*Cyprinus carpio*), followed by rainbow trout (*Oncorhynchus mykiss*), catfish (*Silurus glanis*) and

sturgeon (*Acipenser* spp.). Catches in inland fisheries amounted to approximately 1 000 tonnes in 2024, targeting mainly river lamprey (*Lampetra fluviatilis*), freshwater bream (*Abramis brama*), tench (*Tinca tinca*) and pike (*Esox lucius*) (Eurofish, 2026).

For comparison, the approximately 6 000 breeding cormorants in Latvia are estimated to consume around 3 tonnes of fish per day and more than 540 tonnes during the breeding season.

References

BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union.

Eurofish. 2026. Latvia. By J. Dohmen. In: *Country profile*. [Cited 21 April 2026]. https://eurofish.dk/member-countries/latvia

Latvia. 2007. *Cabinet Regulation No. 778: Procedures for the determination of the amount of losses for users of land which are connected with significant damage caused by specially protected non-huntable species and migratory species of animals.*

Lithuania

Information was received from the Recreational Fishery Council under the Ministry of Environment, through the Ministry of Agriculture of Lithuania.

The Ministry of Environment estimated the number of breeding pairs in 2023 at 8 300 pairs, increasing by about 100 pairs in 2024 to 8 400 pairs.

Conservative assessments previously estimated annual damage caused by great cormorants at approximately EUR 2.5 million, based primarily on average daily fish consumption values (EUR 2.19 in 2023 and EUR 2.47 in 2024) and the size of the breeding population. However, recent national monitoring provides a significantly stronger empirical basis for assessing actual pressure and damage. Standardized bird-day monitoring conducted in 18 pond aquaculture farms during the 2024 production season recorded more than 500 000 great cormorant bird-days and more than 7.1 million bird-days from fish-eating and feed-consuming bird species in total. These results demonstrate strong seasonal and spatial concentration of impacts, particularly during late summer and autumn, which coincides with critical fish growth and harvesting periods.

Table. Estimate of damage caused to fish based on breeding pair estimates

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	16 600 (= pairs × 2)	16 800 (= pairs × 2)	180	6 500 000	7 470 000
Great cormorant	Non-breeding population	unknown	unknown			

Source: Ministry of Environment of Lithuania, 2025.

Cormorants in Lithuania are mainly migratory. Birds arrive at breeding colonies between late February and March, and their numbers decline rapidly from October onward due to migration. Only very small numbers of cormorants remain in winter, as most migrate to Western, Central and Southern Europe or the Middle East. Thus, Lithuania is primarily a breeding area rather than a wintering site, and seasonal population fluctuations are pronounced (Putys, 2013). The study also reported that the Juodkrantė colony of around 3 000 breeding pairs in 2010 consumed 247 kg of fish per breeding pair, including chicks, during the season, amounting to 729 tonnes of fish per year (Putys, 2013).

More recent Lithuanian research, conducted between 2016 and 2023 by the Nature Research Centre and Vilnius University, confirms that great cormorants remain highly efficient piscivorous predators, with an estimated daily fish intake of approximately 300–600 g per adult bird during the breeding season, depending on prey availability and breeding stage (Jasiulionis, 2020; Jasiulionis, Balčiauskas and Balčiauskienė, 2023). Large colonies, such as the Juodkrantė colony and selected inland sites, function as focal points of sustained feeding pressure on nearby inland waters, rivers, lakes and pond aquaculture systems. Contemporary studies do not indicate effective natural self-regulation of the population at current density levels, suggesting that predation pressure on fish resources is likely to persist.

It is recognized that the economic impact of predation by cormorants is significant for pond aquaculture in Lithuania.

The most common production method is ponds, accounting for around 63 percent of total production for consumption. In recent years, the number of aquaculture ponds has remained stable. However, new farmers tend to engage in raceway and recirculating aquaculture systems (RAS), in which production can be controlled better and predation by cormorants is less of a problem. RAS is the fastest-growing

production method. In 2016, the volume of fish from RAS amounted to 0.01 percent of the total; by the end of 2020, this share rose to 17 percent; and in 2024 it reached 35 percent. The most commonly farmed species in Lithuania is common carp, representing around 56 percent of the volume and 50 percent of the value of all fish farmed in 2024. Other cyprinids include bighead carp and crucian carp (Eurofish, 2026). In 2024, total pond aquaculture production, including fish grown for stocking, was 3 000 tonnes. In recent years, inland capture fisheries production has been around 1 400 tonnes, mainly from the Curonian Lagoon (approximately 1 000–1 200 tonnes), and includes bream, roach, pike-perch and vimba (Ministry of Agriculture, n.d.).

Information received from the National Aquaculture and Fish Products' Producers Association showed that, in 2025, there were approximately 8 600 breeding pairs of cormorants in Lithuania, and more than 22 000 individuals in total, including chicks and non-breeding birds. In 2025, the number of breeding cormorants increased by 16.5 percent compared with 2024.

In Lithuania, cormorants visit ponds approximately 600 000 times per year, with an estimated 6 500–7 000 individuals involved. Cormorants consume about 300 tonnes of fish annually. In 2025, the average market price of fish was EUR 3.76/kg, while fry, which cormorants primarily feed on, was 25–50 percent higher, approximately EUR 4.70–5.64/kg. Consequently, in 2025, the damage caused by cormorants to Lithuanian pond farming amounted to approximately EUR 1.68 million.

Recent farm-level monitoring confirms that damage encompasses both direct losses, including fish consumption and injury, and indirect losses, including depletion of supplementary feed, disturbance-induced stress, reduced growth rates and increased disease risk. Monitoring results demonstrate substantial differences between farms, with predation pressure concentrated in specific locations and production systems, indicating that impacts are highly uneven rather than uniformly distributed. In 2023, approximately EUR 250 000 was paid as compensation for damage caused by cormorants, increasing to nearly EUR 440 000 in 2024.

For comparison, using the Ministry of Environment's estimate of 16 600 breeding cormorants in Lithuania (Table), it can be concluded that the seasonal cormorant population consumes around 8.3 tonnes of fish per day and more than 1 500 tonnes during the breeding season. When non-breeding individuals and seasonal aggregations are taken into account, the total annual fish consumption by cormorants is substantially higher than the production of inland capture fisheries.

While aquaculture experiences the most direct and economically visible damage, evidence from Lithuanian studies and stakeholder observations indicates that recreational fisheries in inland waters are also affected. The Recreational Fishery Council and Klaipėda University estimate that some 50 percent of the predation impact on inland and coastal fish stocks in Lithuania comes from the great cormorant. Great cormorants frequently concentrate their feeding activity in shallow lakes, reservoirs, rivers and migratory corridors that are intensively used for angling and fish stocking. This reduces the effectiveness of restocking programmes and contributes to localized declines in fish availability, particularly for roach, perch and other cyprinid species important for recreational fishing. Although comprehensive national-level economic assessments for recreational fisheries are currently lacking, impacts are considered localized but persistent, with cumulative ecological and socioeconomic consequences.

References

Eurofish. 2026. Lithuania. By J. Dohmen. In: *Country profile*. [Cited 21 April 2026]. https://eurofish.dk/member-countries/lithuania

Jasiulionis, M. 2020. *Impact of the colonies of great cormorants* (Phalacrocorax carbo sinensis) *on ecosystems in Lithuania*. Vilnius, Lithuania, Vilnius University and Nature Research Centre. PhD dissertation.

Jasiulionis, M., Balčiauskas, L. & Balčiauskienė, L. 2023. Size matters: diversity and abundance of small mammal communities in relation to the size of great cormorant colonies. *Diversity*, 15(2): 220. [Cited 21 April 2026]. https://doi.org/10.3390/d15020220

Ministry of Agriculture of the Republic of Lithuania. n.d. *The fisheries and aquaculture sector in Lithuania*. Vilnius. Produced in cooperation with Eurofish International Organisation.

Ministry of Agriculture of the Republic of Lithuania. 2025. *Study on the abundance of birds causing damage to aquaculture farms in 2024 at aquaculture farms participating in the implementation of the measure "Implementation of nature management measures" under the 2021–2027 Lithuanian Fisheries Sector Programme*. Final report. [Cited 21 April 2026]. https://zum.lrv.lt/lt/veiklos-sritys/zuvininkyste/es-parama/2021-2027/tyrimai-vertinimai-ir-ataskaitos-2021-2027-m-paramos-programiniam-laikotarpiui

Putys, Ž. 2013. *Great cormorant* (Phalacrocorax carbo sinensis) *feeding ecology and impact on fish communities in the Curonian Lagoon*. Vilnius, Lithuania, Vilnius University, Institute of Ecology. PhD dissertation. 151 pp.

Republic of Moldova

Information was received from the Ministry of Environment of the Republic of Moldova.

The Ministry of Environment estimated the average number of breeding great cormorants over the period 2021–2024 at approximately 12 000 individuals, while the non-breeding population was estimated at around 20 000 birds (Table). The average daily value of fish consumption was estimated at EUR 2.50 per bird. Based on these assumptions, the estimated annual economic damage caused by cormorant predation on fish was approximately EUR 12.8 million in recent years.

The estimated damage caused by other predators, including pygmy cormorants, herons and otters, was significantly lower, amounting to approximately EUR 2.5 million per year.

The total annual consumption of fish by great cormorants in the Republic of Moldova is estimated at more than 2 500 tonnes. By comparison, aquaculture production, consisting mainly of carp species cultured in ponds, exceeded 14 000 tonnes in 2023 (FAO, 2026). Hatcheries produce approximately 1 200 tonnes of fry and fingerlings annually for restocking purposes.

Inland commercial capture fisheries and recreational fishing have effectively been prohibited since 2016, as no quotas have been assigned (Ministry of Environment, 2023). Estimated inland catches are, therefore, approximately 50 tonnes per year.

A compensation scheme is not available for pond farmers for damages caused by cormorant predation. However, great cormorants may be hunted during the official hunting season from 15 August to 15 January (Government of the Republic of Moldova, 2024). This provides a limited management option for fish farmers to mitigate local impacts. Information on investments in preventive measures is not available. Farmers report substantial losses due to opportunistic predation by cormorants in large ponds, including fish killed and injured, although precise estimates are not available.

Table. Estimated damage caused by predation of fish in the Republic of Moldova

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	12 000	12 000	260	7 800 000	7 800 000
Great cormorant	Non-breeding population	20 000	20 000	100	5 000 000	5 000 000
Pygmy cormorant	–	100	100	360	81 000	81 000
Heron	–	5 000	5 000	200	960 000	960 000
Otter	–	800	800	360	1 532 000	1 532 000

Source: Ministry of Environment of the Republic of Moldova.

References

FAO. 2026. Fishery and Aquaculture Country Profiles: Republic of Moldova. In: *Fisheries and Aquaculture*. [Cited 21 April 2026]. https://www.fao.org/fishery/en/facp/MDA

Government of the Republic of Moldova. 2024. *Law on hunting and protection of the hunting fund*. No. 55/2024. [Cited 21 April 2026]. https://www.legis.md/cautare/getResults?doc_id=142753&lang=ro

Ministry of Environment. 2023. *Fisheries and aquaculture production in Moldova*. Ministry of Environment of the Republic of Moldova.

The Kingdom of the Netherlands

Information was received from the Ministry of Agriculture, Fisheries, Food Security and Nature, as well as Sportvisserij Nederland (Sportvisunie).

The Ministry of Agriculture, Fisheries, Food Security and Nature (LNV) estimated the number of breeding pairs at 19 000 pairs in 2023, which, according to Sovon Vogelonderzoek Nederland (Sovon, 2024), declined to about 17 250–18 000 pairs in 2024. The Ministry estimated the annual damage caused by cormorants at approximately EUR 24 million in 2023, which is likely to be an underestimate (see Table and notes below).

The approximately 38 000 breeding cormorants in 2023 do not include offspring (e.g. one- and two-year immature birds), failed breeders or older non-breeding birds. According to Sovon (2024), the number of great cormorants passing through the country in September–October is estimated at 59 500–73 000 individuals.

Table. Estimates of damage caused to fish based on breeding pair estimates and fish prices received from the Ministry of Agriculture, Fisheries, Food Security and Nature (2023) and data from Sovon (2024)

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)*	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	38 000 (= pairs × 2)	36 000	145	13 870 000	13 140 000
Great cormorant	Non-breeding population	28 000	48 000–60 000	145	10 220 000	19 710 000
Heron	–	25 600	26 000	365	8 970 240	9 110 000
Otter	–	450	–	365	873 810	–

Note: The value of daily fish consumption was estimated at EUR 2.50 per cormorant, while for herons it was EUR 0.96/heron and for otters EUR 5.32/otter. These values were based on FAO average fish prices for 2023/2024 and were applied by most countries in this study.
*The number of days of occurrence of breeding cormorants may be an underestimation, as a breeding season of 180–240 days is common (Sovon, 2024; Hornman, Hustings and Koffijberg, 2015).

Cormorants in the Kingdom of the Netherlands are generally migratory. Throughout the year, Lake IJsselmeer and Lake Markermeer host the largest concentrations, followed by the Delta area and the major rivers. In the Wadden Sea, thousands of great cormorants are present in late summer, but only a fraction of that number remains in mid-winter. Counts at communal roosts indicate that up to 50 000 great cormorants are present in the country during mid-winter (Sovon, 2024).

In 2025, Sportvisserij Nederland (Sportvisunie) conducted a survey among its more than 700 member angling clubs to inventory damage caused by cormorants to fish stocks and recreational and sport-fishing activities. A total of 159 clubs responded, and 128 (81 percent) reported damages caused by cormorant predation in 2023 and 2024. Detailed damage information was provided by 88 angling clubs. In 2023, these clubs reported EUR 580 000 in damages and 6 600 hours of volunteer work. In 2024, the responding clubs reported EUR 660 000 in damages and 9 000 volunteer hours.

The survey responses from the 128 angling clubs indicate that cormorant predation is perceived as a widespread, increasing and structurally embedded problem, particularly during autumn and winter. Reported flock sizes range from 3–4 birds on small waters (approximately 2–3 ha) to 30–40 birds on ponds and canals, and in several areas aggregations exceeding 100 birds were observed. Many angling clubs noted that cormorants are now present on a near-daily basis in winter, with repeated use of the same waterbodies. In some systems (e.g. polders, canals and harbours), clubs reported that fish stocks

have been heavily depleted or locally emptied, especially where shallow, clear waters facilitate predation.

The main ecological impacts reported include substantial losses of stocked fish, significant reductions in small and medium-sized classes (particularly 5–20 cm), and visible injuries on larger fish that are too large to be swallowed. Several angling clubs reported missing year classes and a near absence of juvenile fish, indicating impaired recruitment. Species such as cyprinids (roach, bream), perch and zander (pike-perch) were frequently mentioned as strongly affected. In response, some clubs have shifted their stocking strategies towards larger carp or other perceived cormorant-resistant fish. However, these fish also suffer from predation and injuries, as cormorants have been shown to consume fish up to 50 cm in length.

The economic impacts of fish predation by cormorants are significant and recurring, though often difficult to quantify precisely. Reported direct losses from restocking range from hundreds of euros annually for small waterbodies to EUR 1 000–2 000 per year, with additional cases involving EUR 1 500 for emergency stocking, EUR 3 000 for additional carp stocking, and increases of EUR 4 000 in annual stocking budgets to cope with predation pressure while still providing a good fishing experience for members. Several clubs indicated that a substantial share of stocked fish, often more than 50 percent, is rapidly lost to predation.

Investments in mitigation measures, including fish refuges (brush bundles, reed structures), floating islands and pilot habitat projects, can range from EUR 5 000 to EUR 10 000. One club reported cumulative expenditures of approximately EUR 30 000 over multiple years. These costs are compounded by substantial volunteer labour requirements, often involving many tens or hundreds of hours annually for activities such as installation, maintenance and bird scaring.

Beyond direct financial costs, respondents emphasized substantial social and organizational impacts. Declining fish stocks have led to reduced catch rates, directly affecting member satisfaction and participation. Several clubs reported a loss of members, reduced attractiveness of their waters, and declining engagement from recreational and competitive anglers. Youth angling activities are particularly affected: clubs noted that school fishing lessons and youth competitions cannot be effectively organized owing to a lack of catchable fish, with some clubs reporting that large groups of children often catch just a few fish. In some cases, winter competitions were cancelled, resulting in loss of canteen revenue and broader club income. These effects undermine the social role of angling clubs in local communities and reduce opportunities for outdoor recreation and environmental education.

The angling clubs reported implementing a wide range of mitigation measures, including habitat enhancement (fish shelters, vegetation), deterrence (lasers, noise devices, visual deterrents) and increased human presence. However, these measures are widely perceived as only partially effective, site-specific, or incompatible with other water uses such as navigation or urban functions. A common conclusion across the responses is that local measures alone are insufficient to offset cormorant predation pressure. Many angling clubs, therefore, have called for broader, coordinated management responses at the regional or national level, citing an imbalance between the protected status of cormorants and the socioeconomic impacts experienced at the local level.

The more than 700 angling clubs organized under the umbrella of Sportvisserij Nederland (Sportvisunie) have approximately 700 000–746 000 affiliated anglers. The average angling club size in the Kingdom of the Netherlands is estimated at around 1 000 members per club, although considerable variation exists between small rural associations and larger urban organizations. The damage figures reported by 159 angling clubs could be multiplied by four to obtain a conservative estimate of the total annual damages encountered by the sport and recreational fisheries sector as a result of cormorant predation. On this basis, more than EUR 2.5 million is conservatively estimated to be spent annually on additional fish stocking and mitigation measures (e.g. fish refuges, floating islands

and netting). Similarly, the overall volunteer time spent by angling clubs in the country on cormorant prevention and mitigation in 2024 could be multiplied by four, for an estimated total of 36 000 hours.

In accordance with international statistical standards, the economic value of volunteer work can be estimated using a replacement-cost approach, valuing volunteer time at the wage rate of equivalent paid labour (ILO, 2011; OECD, 2018). For practical applications in the Kingdom of the Netherlands, a benchmark value of EUR 15–25 per hour is commonly applied. Therefore, the total annual economic value of volunteer work by angling clubs in 2024, related to preventing and mitigating damage caused by cormorants, is estimated to range from EUR 540 000 to EUR 900 000. To sum up, the costs of cormorant predation to sport and recreational fisheries in the country are estimated at EUR 3–3.5 million per year.

BIJ12 is the implementing organization in the Kingdom of the Netherlands, acting on behalf of the 12 Dutch provinces, for the collection and analysis of damages caused by protected wildlife to farms and domestic animals. Farmers experiencing damage caused by geese, crows, ducks and wolves, for instance, can claim compensation, which is paid after review using standard compensation prices.

BIJ12 reported that no compensation scheme exists for damage caused by cormorants. Its policy covers only damage to agriculture, defined as livestock farming, arable farming, open-field vegetable cultivation, osier cultivation, reed cultivation, pasture farming and horticulture. The following are not considered agriculture: fisheries, mussel and oyster cultivation, and other forms of shellfish farming, as these activities do not take place on land. Nor are these crops grown in open ground and open air (BIJ12, 2025).

Although compensation is not yet available, damage caused by cormorants can be reported through the FaunaSchadeRegistratie website to record such cases. The information recorded includes whether the damage is commercial or private, the type of damage (e.g. fish or, in some cases, crops), the reporting party and the date (FaunaSchadeRegistratie, n.d.).

In the Kingdom of the Netherlands, cormorant predation damages to freshwater aquaculture are limited because few commercial pond-culture farms remain. Most aquaculture production occurs in indoor recirculating aquaculture systems. In contrast to freshwater aquaculture and inland fisheries, cormorant predation does not represent a significant pressure on mussel culture in the Oosterschelde and Wadden Sea. Mussel production losses are primarily driven by invertebrate predation (e.g. starfish), environmental variability and hydrodynamic disturbance, while cormorants mainly exploit fish associated with culture plots (e.g. flatfish) rather than the shellfish themselves. Researchers recognize that more research is needed on the impact of various bird species on mollusc banks in the Waddenzee (Capelle, van den Bogaart and van Stralen, 2021).

In 1991, the Dutch Organisatie ter Verbetering van de Binnenvisserij (OVB) decided to close its 218 ha fish culture facilities in Lelystad, in the province of Flevoland, because of devastating predation by cormorants from a nearby colony. The same colony was actively supported in its establishment and growth by other government institutions. The fish culture facility operated from 1964 to 1991, cultured 15 species, maintained broodstock and supplied stocking material to improve inland biodiversity throughout the country (Flevoland Erfgoed, n.d.; Open Monumentendag, 2024). The impact of cormorant predation on fish culture in the Kingdom of the Netherlands was documented as early as the 1980s (Voous, 1982). The closures of private-sector pond culture farms attributed to cormorant predation are not well documented.

References

BIJ12. 2025. *Tegemoetkoming in faunaschade*. Utrecht. [Cited 21 April 2026]. https://www.bij12.nl/onderwerp/faunaschade/tegemoetkoming-in-faunaschade

Capelle, J.J., van den Bogaart, L.A. & van Stralen, M.R. 2021. *Passende beoordeling mosselzaadvisserij in het sublitoraal van de Westelijke Waddenzee in de periode 2021–2026*. Wageningen Marine Research. Rapport No. C041/21. Wageningen Marine Research. [Cited 21 April 2026]. https://doi.org/10.18174/545266

FaunaSchadeRegistratie. n.d. Faunaschade Registratie. *Online platform for reporting wildlife damage*. The Netherlands. [Cited 21 April 2026]. https://www.faunaschade.nl/default.aspx

Flevoland Erfgoed. n.d. *Hevelhuisje (viskwekerij Lelystad)*. Lelystad, the Netherlands. [Cited 21 April 2026]. https://www.flevolanderfgoed.nl/home/erfgoed/oostelijk-flevoland-2/lelystad/hevelhuisje.html

Hornman, M., Hustings, F., Koffijberg, K. *et al*. 2015. *Watervogels in Nederland 2014/2015*. Sovon Vogelonderzoek Nederland and Rijkswaterstaat.

ILO (International Labour Organization). 2011. *Manual on the measurement of volunteer work*. Geneva. [Cited 21 April 2026]. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@stat/documents/publication/wcms_162119.pdf

OECD (Organisation for Economic Co-operation and Development). 2018. *Including unpaid household activities: an estimate of its impact on macro-economic aggregates*. Paris. [Cited 21 April 2026].

Open Monumentendag. 2024. *Rapport waardestelling viskwekerij Lelystad*. The Netherlands. [Cited 21 April 2026]. https://www.openmonumentendag.nl/wp-content/uploads/2024/08/Rapport-waardestelling-viskwekerij.pdf

Sovon (Sovon Vogelonderzoek Nederland). 2024. *Great cormorant* (Phalacrocorax carbo): *national population statistics*. [Cited 21 April 2026]. https://stats.sovon.nl/stats/soort/720

Voous, K.H. 1982. De Aalscholvers van Lelystad: toetssteen van milieubeleid. *Het Vogeljaar*, 30(3): 135–140. [Cited 21 April 2026]. https://natuurtijdschriften.nl/pub/543379/HVJ1982030003003.pdf

Norway

The Norwegian Environment Agency informed EIFAAC that recent estimates of cormorant predation in Norway are not available.

The latest estimate of the number of breeding great cormorants in Norway is from 2020. The number of great cormorant subspecies *Phalacrocorax carbo sinensis* that year was estimated at 2 500 pairs. It is mainly this great cormorant subspecies that occurs in inland waters in Norway. A study from 2018 revealed that the diet of *P. c. sinensis* included many species. In general, the diet consisted of 33.3 percent whitefish (*Coregonus lavaretus*), 25.7 percent vendace (*Coregonus albula*), 22.7 percent perch (*Perca fluviatilis*), 6.2 percent grayling (*Thymallus thymallus*), 3.0 percent trout (*Salmo trutta*), 1.5 percent smelt (*Osmerus eperlanus*) and 0.5 percent burbot (*Lota lota*).

Estimates exist of cormorant (*Phalacrocorax carbo*) predation of fish in marine waters from 2020 (Dehnhard *et al.,* 2021). The analysis by Dehnhard *et al*. (2021) revealed that the conflict between great cormorants and fisheries for human consumption was small or negligible, particularly for cod and saithe; however, it recognized a potential conflict because of the large number of wrasses taken by great cormorants in the Greater North Sea area.

The Table presents data from studies by Dehnhard *et al*. (2021) and Fauchald *et al*. (2015). Annually, the estimated damage caused by cormorants to fish populations, fisheries and aquaculture amounts to more than EUR 46 million.

Table. Estimates of the number of cormorants in Norway and damages caused

	Estimated number of adult individuals (2015) and 1- and 2-year-old birds (2020)	Occurrence in the year (days)	Estimated damage (EUR)*
Great cormorant breeding population	38 000 (*Phalacrocorax* carbo) and 5 400 (*P. c. sinensis*)	270 (*P. carbo*) and 180 (*P. c. sinensis*)	28 080 000
non-breeding population	24 848 (*P. carbo*) and 3 531 (*P. c. sinensis*)	270 (*P. carbo*) and 180 (*P. c. sinensis*)	18 360 000

* Estimated damages caused were calculated by the EIFAAC Secretariat, using an estimated daily fish consumption of 0.5 kg per cormorant with an estimated value of EUR 2.5/day.
Sources: Fauchald *et al*. (2015); Dehnhard *et al*. (2021).

References

Dehnhard, N., Langset, M., Aglen, A., Lorentsen, S.-H. & Anker-Nilssen, T. 2021. Fish consumption by great cormorants in Norwegian coastal waters – a human-wildlife conflict for wrasses, but not gadids. *ICES Journal of Marine Science*, 78(3): 1074–1089. https://doi.org/10.1093/icesjms/fsab004

Fauchald, P., Anker-Nilssen, T., Barrett, R.T., Bustnes, J.O., Bårdsen, B.-J., Christensen-Dalsgaard, S., Descamps, S., Erikstad, K.E., Hanssen, S.A., Lorentsen, S.-H., Reiertsen, T.K., Systad, G.H. & Strøm, H. 2015. *The status and trends of seabirds breeding in Norway and Svalbard.* NINA Report, No. 1151. Tromsø, Norway, Norwegian Institute for Nature Research (NINA).

Poland

Information was received from the Department of Fisheries of the Ministry of Agriculture and Rural Development of Poland and the Polish Angling Association. This summary is accompanied by a detailed report on damages caused by cormorants in Poland, prepared by Igor Wawrzyniak of the Ministry of Agriculture and Rural Development (see Annex 1).

In 2025, the Cormorant Monitoring Programme (MKO) recorded a total of 27 593 breeding pairs (nests) of great cormorants in Poland, in 75 colonies within 73 areas of 10 × 10 km. Despite annual fluctuations, the size of the breeding population remained stable between 2015 and 2025. The largest colony in 2025 comprised 5 830 pairs and was located on Chełminek, an artificial island in the Szczecin Lagoon. Inland colonies are increasing, while coastal colonies are showing a slight decline (GIOŚ, 2025). The Chief Inspectorate of Environmental Protection (GIOŚ) distinguishes between sedentary and migratory (flyover) non-breeding cormorants, as shown in Table 1.

The estimated total value of fish consumed by great cormorants in Poland in 2023 and 2024 was approximately EUR 42 million annually. In 2024, the estimated number of cormorant-days in Poland amounted to 16.9 million days. The average daily fish consumption by a great cormorant was estimated at 0.5 kg per bird per day. Total fish consumption by cormorants in Polish waters (inland and coastal) was estimated at 8 450 tonnes for the year.

Table 1. Estimate of damage caused by cormorants to fish in Poland, based on breeding-pair and non-breeding individual estimates from GIOŚ and average fish prices

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)*	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	58 732	57 600	180	26 429 000	25 920 000
Great cormorant	Non-breeding population (sedentary)	35 975	36 221	180	16 189 000	16 299 000
Great cormorant	Non-breeding population (flyover)	3 029	2 781	14	106 000	97 000

Note: The value of daily fish consumption was estimated at EUR 2.50 per cormorant. This value was based on FAO fish price averages for 2023–2024 and applied by most countries in this study.
*The number of occurrence days for breeding cormorants may be underestimated, as a breeding season of 180–220 days is common.
Source: Chief Inspectorate of Environmental Protection (GIOŚ, 2025).

In 2025, the Polish Angling Association conducted a survey among angling clubs and select pond fish farmers. Thirty-eight angling clubs and fish farmers from different regions of Poland submitted data and information on damage caused by cormorants to fish in 2023 and 2024 (Table 2). The respondents were responsible for management and fish production over tens of thousands of hectares, though detailed information was not always available. Ten respondents reported managing 31 564 ha of water and pond area.

The angling clubs and fish farmers estimated that damage to fish in the waters under their management amounted to approximately EUR 24 million in 2023 and nearly EUR 22 million in 2024. None of the 38 respondents received compensation for damages caused by cormorants or other predators in 2023 or 2024.

Table 2. Estimate of damage caused by the main piscivorous predators reported by 38 angling clubs and fish farmers in Poland, based on counts and average fish prices

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)*	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	10 928	8 622	192	5 245 440	4 138 560
Great cormorant	Non-breeding population (wintering)	31 037	29 602	174	13 501 095	12 876 870
Heron	–	5 459	5 370	251	1 315 401	1 293 955
Otter	–	2 354	2 142	311	3 894 740	3 543 982

*Average number of days reported by respondents.

Permissions for culling were granted for 1 219 cormorants in 2023 and 739 cormorants in 2024. The number of culled cormorants was 470 in 2023 and 322 in 2024. An analysis published in January 2026 on the West Pomeranian Angling Portal indicated that in 2024-2025 permits were issued nationwide to cull approximately 3 000 cormorants. It is estimated that only half of this limit was used (Pavlinec, 2026).

The responding angling clubs also reported costs for prevention and mitigation of cormorant damage, amounting to EUR 137 000 in 2023 and EUR 60 000 in 2024.

Using data from the Polish Society for the Protection of Birds, the Polish Angling Association reported that cormorants currently exploit all types of Polish waters, including lakes, reservoirs and rivers, as well as mountain and foothill rivers that are habitats for fish species of particular conservation value. Climate change and its associated warming have resulted in cormorants remaining and feeding in Poland during winter, which had not been previously observed.

Assuming that a cormorant consumes an average of 0.45 kg of fish per day during the breeding season, it is estimated, based on long-term observations, that the breeding population consumes 4 673 700 kg of fish during its 180-day stay in Poland. The biomass consumed by migratory birds should also be added to this estimate. The migratory population consumes at least 55 000 kg of fish per day. The wintering population, estimated at 15 000–75 000 individuals, consumes between 740 kg and 3 700 kg of fish per day during the winter months of December, January and February. In total, the biomass of fish eaten by cormorants in Polish waters during the year may exceed 8 000 tonnes.

The Polish Angling Association further reported that cormorant predation affects not only low-value species but also those used in commercial and recreational fisheries. Cormorants also prey on endangered species, including species listed in Annex II of the Habitats Directive (e.g. asp and the spotted barbel), Annex V (e.g. barbel and grayling), and Annex III of the Bern Convention (e.g. European whitefish, vendace, vimba and nase). Eels are also preyed upon by cormorants in the country. The association noted that the argument sometimes used by bird conservationists – that endangered species account for only a small share of the cormorant diet – is misleading, because even 1 percent of the total biomass consumed in Poland would amount to around 80 tonnes of fish annually.

One report from a Polish commercial fishery stated that restocking in Jeziora Raduńskie (the Raduńskie Lakes) had been discontinued. The lake is still fished, but previous annual stocking of eel, vendace, whitefish, pike-perch and other species, valued at EUR 38 000 per year, was terminated because cormorant predation pressure was too high to sustain it.

Box. Example of a Polish angling club report

The Polish Angling Association (PZW) District in Chełm reported that cormorants (*Phalacrocorax carbo*) caused significant damage in 2024 along the Bug River and adjacent lakes in eastern Poland. Cormorants were first observed in late 2023, with a marked increase during autumn and early winter 2024. The population was estimated at approximately 1 500 individuals, distributed along the Bug River bordering Ukraine and Belarus.

Based on standard consumption assumptions of 0.5 kg of fish per bird per day, total daily fish consumption by cormorants was estimated at 750 kg. Over the period September–December 2024 (122 days), total fish losses were estimated at 91.5 tonnes. Using an average fish value of PLN 15/kg, total economic losses were calculated to be PLN 1.37 million (approximately EUR 302 000).

The report states that these estimates are based on field observations and simplified consumption models. Mitigation efforts included a formal request to regional environmental authorities to implement deterrence measures at affected lakes.

The findings illustrate the substantial localized economic impact of cormorant predation on inland fisheries and angling waters, particularly in transboundary river systems, and underscore the need for effective management and mitigation strategies.

Polish pond fish farmers also reported significant damage caused by cormorants to fish stocks and farm income. Eight pond fish farms provided detailed damage information from farm records. The farms primarily cultured common carp, grass carp and silver carp. Their total pond area (water surface) was 1 735 ha, with pond sizes ranging from 9 ha to 455 ha. In recent years, the eight farms produced an average of 1 222 tonnes of fish, with the smallest farm producing 5 tonnes per year and the largest 418 tonnes per year.

The farms reported fish losses due to cormorant predation ranging from 5 percent to 55 percent, while the estimated proportion of fish damaged by cormorants ranged from 5 percent to 37 percent. The wintering population caused the highest monetary losses, as cormorants preyed mainly on one- and two-year-old carp. Farmers reported that fish counts in spring could be 30 percent lower than in autumn. In 2024, the total loss of income for the eight farms owing to cormorant predation was estimated at EUR 415 000. Losses ranged from EUR 1 300 to EUR 125 000. The average cormorant-related damage per hectare of fish pond was approximately EUR 239/ha.

The Ministry of Agriculture and Rural Development reported aquaculture production in 2023 from a total fish pond area of 61 876 ha, compared with 64 035 ha in 2022 and 63 297 ha in 2021. The total registered area of fish ponds in 2020 was 86 975 ha, though not all ponds were actively used.

Applying the average annual damage of EUR 239/ha to Poland's approximately 61 000 ha of fish ponds in use results in an estimated total annual damage to pond aquaculture of EUR 14.6 million. The Government of Poland does not provide compensation for cormorant-related damage to aquaculture.

References

GIOŚ (Główny Inspektorat Ochrony Środowiska). 2025. *Monitoring kormorana (MKO). Monitoring ptaków Polski*. Warsaw. [Cited 21 April 2026]. https://monitoringptakow.gios.gov.pl/kormoran.html

Pavlinec, A. 2026. Conflict over cormorants in the Opole region – ecologists question approval for culling. *Wodnes*prawy, 17/2025 [Cited 21 April 2026]. https://wodnesprawy.pl/en/conflict-over-cormorants-in-the-opole-region

Romania

Information was received from the Romanian National Fish Producers Association (Romfish) and the General Association of Hunters and Anglers from Romania (AGVPS). Data presented were provided by the Romanian Ministry of Environment, Waters and Forests to the EEA; additional information was collected from nine pond fish farms.

The Ministry of Environment, Waters and Forests estimated the average number of breeding great cormorants at 28 500 individuals and the wintering (non-breeding) population at 77 778 birds in 2022 (Table 1). These values were used for 2023 and 2024. The average value of fish consumption per day per great cormorant was estimated at EUR 1.80 in 2023 and EUR 1.87 in 2024. In recent years, the estimated damage caused by great cormorant predation on fish has been around EUR 45 million annually.

Table 1. Estimated damage caused by fish predators in Romania

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)**	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population*	28 500	28 500	210	10 773 000	11 184 000
Great cormorant	Non-breeding population*	77 778	77 778	240	33 600 000	33 883 000
Pygmy cormorant	–	16 000	16 000	210	5 418 000	5 279 000
Pelican	–	14 200	14 200	90	6 901 000	7 165 000
Heron	–	20 440	20 440	210	3 691 000	3 597 000
Otter	–	1 782	1 782	365	3 342 000	3 441 000

*Data provided by Romania to the European Environment Agency for 2022.
**Number of days in a normal year. Because winters in Romania have been mild in recent years, the wintering population has increased.
Source: https://sdi.eea.europa.eu/data/0801ff11-24ae-4c6b-852f-029965df5bc5?path=%2F

Total fish predation by other predators, such as pygmy cormorants, pelicans, herons and otters, was lower than that by great cormorants, but still substantial. The average daily fish consumption by predator in 2023/2024 was EUR 1.60 for pygmy cormorants, EUR 5.61 for pelicans, EUR 0.85 for herons and EUR 5.22 for otters. In recent years, the total annual damage caused by other predators has been estimated at around EUR 19.3 million.

In the past few years, the Ministry of Environment, Waters and Forests has not granted any derogations to aquaculture farmers for culling great cormorants preying on their fish stocks. Although requests from farmers were numerous, no derogations were granted. Nevertheless, in 2025, the Government of Romania agreed that fish farms located within Natura 2000 areas could receive compensation of EUR 100/ha per year for restrictions imposed by management plans or by minimum protection rules in areas where management plans have not yet been developed and approved (Government of Romania, 2025). In 2025, applications for this scheme were submitted for 18 090 ha of fish farms, but compensation had not yet been paid. The scheme does not apply to farms outside Natura 2000 areas, and derogations are still not provided.

Romfish received data on fish pond damage from several farms. Records from two farms, one of 782 ha (grow-out production, 2019 data) and another of 45 ha (fish nursery and grow-out production, 2018 data), revealed losses of 94 kg/ha and 371 kg/ha, respectively, in one year, largely because of cormorant predation. The losses in quantity were 73.1 tonnes and 16.7 tonnes, respectively. At off-farm prices, the losses amounted to EUR 134 000 for the larger grow-out farm. The smaller farm, with fry and fingerling

production, recorded losses of 4.2 tonnes of fry, 4.8 tonnes of fingerlings, and the remainder in two-summer-old carp. Given that the average hatchery prices for carp fry (1 g/individual), fingerlings (one-summer-old carp) and two-summer-old carp were EUR 4.87/kg, EUR 2.31/kg and EUR 2.47/kg, respectively, the loss of income for the smaller farm was around EUR 53 000 (Table 2).

Table 2. Market prices for carp species in Romania in EUR (2014–2019)

Polyculture	2014	2015	2016	2017	2018	2019
Fry (1g/individual)	4.4	4.57	4.5	4.38	4.87	4.83
One-summer-old carp	2.08	2.16	2.15	2.08	2.31	2.34
Two-summer-old carp	2.23	2.32	2.33	2.22	2.47	1.81
Market-sized carp	1.54	1.6	1.61	1.55	1.72	1.85

Source: Romfish data.

Romfish members also recorded predator damage in seven pond fish farms over the period 2014–2019. During that period, the pond area of the farms that was in use fluctuated between 3 000 and 2 750 ha. The ponds varied in size, ranging from 0.4 ha for fry ponds to 275 ha for grow-out ponds. The main species cultured was common carp, but other carp species such as Prussian carp, bighead carp, grass carp and silver carp were also cultured. One farm also had ponds for pike-perch (sander) production. The farms kept records of their losses due to predation by cormorants, other predatory birds and otters.

Table 3 shows that average predation losses were 41 tonnes per farm in the period 2014–2019. Considering the average pond area of 393 ha, the predation loss per hectare was about 110 kg, with a market value of EUR 312. The average loss per farm attributed to predators was 46 tonnes in 2019, which had a value of nearly EUR 123 000 in 2019 fish prices. In 2019, the total loss recorded by the seven farms, excluding larvae, amounted to 325 tonnes, with a market value of EUR 860 000.

Table 3. Summary of fish farm records from seven farms on production and losses from predation in the period 2014–2019

Fish farm	Pond area in hectares in 2019	Average fish biomass harvested in tonnes (2014–2019)	Average loss in tonnes from predation (2014–2019)	Loss in tonnes from predation (2019)	Income loss in 2019 from predation (EUR)
1	683	193	62	78	160 328
2	286	198	1	23	63 894
3	93	33	12	10	26 327
4	277	270	46	36	91 171
5	171	55	17	12	24 490
6	779	359	93	95	339 827
7	460	658	53	69	154 256
Average	393	252	41	46	122 899
Total	**2 749**	**1 766**	**285**	**325**	**860 293**

Note: Larval losses are not included.

There are around 87 000 ha of fish ponds in use in Romania (ANPA, 2025). Assuming other pond fish farmers encounter similar predation-related losses of 110 kg/ha, the estimated total predation loss for pond aquaculture farmers would be 9 570 tonnes, with a market value of EUR 27 million. Fish farmers indicated that cormorant-related losses increased further after 2019, severely effecting fish production and farm incomes.

For comparison, aquaculture production in Romania was about 11 000 tonnes in 2023. In the same year, inland capture fisheries accounted for some 3 500 tonnes and marine fisheries for about 2 500 tonnes (ANPA, 2025). The total off-farm value of aquaculture production was estimated at EUR 38 million in 2023.

References

Government of Romania. 2025. Hotărâre nr. 216/2025 pentru aprobarea modalității de solicitare, de calcul și de acordare a compensațiilor pentru activitățile de acvacultură din ariile naturale protejate. Monitorul Oficial al României, Partea I, Nr. 209, 10 March 2025.

ANPA (National Agency for Fisheries and Aquaculture). 2025. Date statistice – pescuit comercial ape interioare. ANPA statistical data page. [Cited 21 April 2026]. https://www.anpa.ro/?page_id=396

Serbia

Information was received from the Ministry of Environmental Protection and the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia. The Ministry of Environmental Protection compiled data on the abundance of predatory species based on information from the Institute for Nature Conservation of Serbia, which in turn used data from Serbian organizations affiliated with BirdLife International.

The Institute for Nature Conservation estimated the average number of breeding great cormorants at 1 980 individuals in 2023–2024 (Table). The average wintering (non-breeding) population was estimated at approximately 14 000 birds, based on BirdLife International data for the period 2013–2018 (BirdLife International, 2021). The average daily value of fish consumption per cormorant was estimated at EUR 2.50. Based on these assumptions, the annual economic damage caused by great cormorant predation was estimated at approximately EUR 8.1 million in recent years.

The damage caused by other predators, including pygmy cormorants and herons, was lower and estimated at approximately EUR 2.2 million annually.

Data on fish pond damage were obtained from six farms operating ponds at seven locations. These farms manage approximately 1 550 ha of ponds, primarily culturing common carp and other carp species, while two farms operate raceway systems for trout production.

Table. Estimated damage caused by fish predators in Serbia

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant	Breeding population	1 980	1 980	365	1 807 000	1 807 000
Great cormorant	Non-breeding population*	8 000–20 000	8 000–20 000	180	6 300 000	6 300 000
Pygmy cormorant	–	1 600	1 600	365	1 314 000	1 314 000
Heron	–	4 100	4 100	240	945 000	945 000

*Non-breeding population estimate based on BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union and Puzović *et al*. 2015. *Birds of Serbia: breeding population estimates and trends for 2008–2013*. Novi Sad; an average of 14 000 individuals was used for damage calculations.

In Serbia, the large carp ponds cannot be covered with nets; however, scaring and culling of birds are possible mitigation measures. A compensation scheme is not available for pond farmers for damage caused by cormorants. However, under the Law on Game and Hunting (Government of Serbia, 2010), hunting of great cormorants is permitted throughout the year.

Four pond aquaculture farms reported an annual production of approximately 2 000 tonnes of carp. These farms reported production losses from cormorant predation ranging from 12 percent to 30 percent, with an additional 16–25 percent of fish being damaged. This significantly affects market prices and overall farm profitability. The combined annual income loss for these farms attributed to cormorant predation was estimated at EUR 1.3 million.

Raceway farms reported lower impacts, with approximately 2 percent of fish killed and 1 percent damaged by cormorants. The average annual income loss for these farms was approximately EUR 22 000.

In Serbia, there are approximately 12 000 ha of fish ponds (Naša Riba, 2022; FAO, 2026). Assuming similar predation pressure across all ponds, extrapolation suggests an annual income loss of approximately EUR 10 million attributed to cormorant predation.

The estimated off-farm value of Serbian aquaculture production is approximately EUR 30 million per year. This indicates that predation losses equivalent to around EUR 10 million have a significant impact on farm profitability and fish availability in the domestic market.

References

FAO. 2026. Serbia. In: *Fisheries and Aquaculture*. [Cited 21 April 2026]. https://www.fao.org/fishery/en/countrysector/rs/en

Government of Serbia. 2010. Law on Game and Hunting. *Official Gazette of the Republic of Serbia*. No. 18/10. [Cited 21 April 2026]. https://faolex.fao.org/docs/pdf/yug42047E.pdf

Naša Riba. 2022. *Serbian fishery industry*. [Cited 21 April 2026]. https://nasariba.rs/en/serbian-fishery-industry

Slovakia

Information was received from the Ministry of Agriculture and Rural Development of Slovania and the Slovak Anglers Association. According to the Ministry of the Environment, the number of great cormorants in Slovakia in 2023–2024 was estimated at 9 798–13 214 birds, with nearly all being part of the wintering population. The breeding population is small. During the same period, the populations of great white egret (*Ardea alba*) and grey heron (*Ardea cinerea*) were estimated at 2 000–3 200 and 1 000–2 000 birds, respectively.

The number of counted birds increased significantly compared with the BirdLife International estimate of 4 800–6 700 wintering birds for 2013–2018.

The average fish consumption per day per cormorant was valued at EUR 2.5. On this basis, the annual damage caused by great cormorant predation on fish has been estimated at around EUR 4.3 million in recent years (Table).

Table. Estimated damage caused by fish predators in Slovakia

	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant Breeding population	No information	No information			
Non-breeding population*	11 500	11 500	150	4 313 000	4 313 000
Great white egret**	2 600	2 600	180	786 000	786 000
Grey heron**	1 500	1 500	365	919 000	919 000

*This is the average of the range for 2023–2024, as no annual figure was provided. For cormorants, the occurrence of the wintering population over five months was applied, as advised by BirdLife International (2021).
**The average daily consumption of great white egrets and grey herons was estimated at 350 g of fish and 100 g of amphibians and other animals. Daily fish consumption was estimated at EUR 1.68 per bird.

Derogations for hunting cormorants were granted and, in the period from 28 February 2022 to 15 March 2024, 289 birds were reported culled. The government also has a compensation scheme for damage. In Slovakia, compensation for damage caused by protected species, including cormorants, is determined on a case-by-case basis and may cover up to the full verified damage. However, no fixed compensation rate is defined in legislation, and payments depend on compliance with preventive measures and verification procedures (Government of Slovakia, 2002).

Total compensation paid for damages caused by great cormorants to fish amounted to EUR 350 848 in 2023 and EUR 654 155 in 2024. Some of these payments related to claims from the previous year. Compensation was available only to fish farmers and not to angling clubs for restocking their fishing grounds.

Compensation was also paid to fish farmers for predation damages caused by great white egrets and grey herons. Compensation for great white egrets amounted to EUR 226 639 in 2023 and EUR 263 726 in 2024. Compensation for grey herons amounted to EUR 603 402 in 2023 and EUR 578 222 in 2024.

In 2023, aquaculture production in Slovakia was 2 768 tonnes live weight, consisting mainly of carp in ponds (more than 650 tonnes), trout in raceway systems (more than 1 000 tonnes) and some catfish in recirculation systems (approximately 850 tonnes). The pond area in use was 2 069 ha, while raceway and recirculation systems had a combined capacity of approximately 140 503 m³. Freshwater capture fisheries catch in 2023 was 1 655 tonnes, as reported by the Slovak Anglers Association (FAO, 2026).

Predation by cormorants occurs mainly in fish ponds, rivers and lakes. The off-farm value of harvested carp species in 2023 was more than EUR 1.6 million. The loss of production is unknown, but farmers in the Association of Fish Farmers in Slovakia reported that predation affects farm profitability.

The Slovak Anglers Association reported that 90 percent of predation on fish in natural waters can be attributed to cormorants, indicating that the impact of cormorants on aquatic biodiversity is much greater than that of other fish-eating birds such as the grey heron and common merganser. Fish stocks in natural waters affected by cormorant predation include grayling, nase, vimba, barbel, chub, brown trout, carp, pike and pike-perch. No data were available on fish predation by otters.

The Slovak Anglers Association estimated damages caused by cormorant predation to fish stocks managed by its members at around EUR 5.1 million in 2023 and EUR 7.4 million in 2024. These estimates were prepared by national experts using data on fish restocking investments, preventive measures, and information on scaring, chasing and hunting costs. The main predation problems are caused by the wintering population of cormorants from the Baltic Sea, which has grown over the past decade.

References

BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union.

FAO. 2026. Fishery and aquaculture country profiles: Slovakia, 2024. Country Profile Fact Sheets. In: *Fisheries and Aquaculture*. Rome.

Government of Slovakia. 2002. Act No. 543/2002 Coll. on Nature and Landscape Protection, as amended, and Decree No. 24/2003 Coll. implementing the Act.

Spain

Information was received from the Spanish Ministry of Agriculture, Fisheries and Food and from FEAP members in Spain.

The number of great cormorants in Spain was estimated in the country's national report under Article 12 of the Birds Directive for the period 2008–2012 at 49 323–55 927 wintering birds and 532 breeding pairs. For the subsequent reporting period, 2013–2018, the wintering population was estimated at 70 000–80 000 birds and the breeding population at 1 000–2 000 pairs (EAA, 2020). These data indicate an increasing trend in both the wintering and breeding populations. A national census, coordinated by the Spanish Ornithological Society (SEO)/BirdLife International, is underway in Spain and may be finalized before the end of 2026.

The average daily value of fish consumed per cormorant in Spain was estimated at EUR 2.5. Using data from the European Environment Agency, the estimated annual damage caused by predation by great cormorants on fish amounts to approximately EUR 35.1 million in both 2023 and 2024 (Table 1); however, this is likely to underestimate the true level of damages given the increasing cormorant population. The Ministry considers that this estimate does not fully capture regional variability or all sectors affected by bird predation.

Table 1. Estimated damage caused by cormorants to fish, fisheries and aquaculture in Spain

	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)	Estimated damage in 2024 (EUR)
Great cormorant Breeding population	1 500	1 500	365	1 369 000	1 369 000
Non-breeding population	75 000	75 000	180	33 750 000	33 750 000

Note: This is the average of the 2023–2024 range, as no annual figure was provided. For cormorants, the occurrence of the wintering population over six months was applied.

A report was received from the Statistics Service of the Ministry of Agriculture, Fisheries and Food on a survey conducted in 2023 of all aquaculture farms in Spain. The survey addressed the impact of predators on aquaculture, including predation by birds. Farmers emphasized that the great cormorant caused, by far, the greatest predation impact.

The survey revealed that, of the 5 204 aquaculture farms in Spain, including marine and inland farms, 2 893 farms (56 percent) were affected by predators. Preventive measures to reduce predation were taken by 1 735 farms, with more than 1 000 farms using nets. However, the complete use of nets is not feasible on larger farms (MAF, 2024).

Of the 159 inland aquaculture farms, which mainly use pond culture, 108 farms (68 percent) reported that production was affected by predators. Eighty-nine percent of inland aquaculture farms reporting predation indicated that birds, chiefly cormorants, were the main problem. Preventive measures to reduce predation were taken by 103 farms (65 percent) of the 159 inland fish producers.

Within the group of rainbow trout pond farmers, 68 of 114 farms reported being affected by bird predation, and 55 reported that production was negatively affected. Eighty-six trout farms (75 percent) had taken preventive measures to reduce the predation, mainly through mechanical measures such as

scaring devices and nets. All 17 producers of carp in natural ponds or lakes reported bird predation and indicated that it was negatively affecting production. Nine of the carp farms had taken preventive measures, mainly gas cannons or other sound-producing bird-scaring devices.

In marine aquaculture, fish predation was the most prevalent problem, with birds reported by only 6 percent of farms as affecting production. However, 25 of the 35 marine cage farms producing seabass or seabream reported being affected by bird predation, and 21 of those farms reported that production was negatively affected. Thirty-one farms (89 percent) producing seabream and seabass in cages used nets to prevent bird predation (MAF, 2024).

Andalusia

The Marine Aquaculture Producers Association of Andalusia (ASEMA) reported to FEAP that approximately 20 000 cormorants prey on fish in the region, particularly during the wintering period. The association estimated the total cost of cormorant predation on seabass and seabream at marine fish farms in Andalusia to be approximately EUR 2.3 million.

Information from 12 Andalusian fish farmers was compiled, covering ponds at 15 locations. The main species cultured were European seabass and gilthead seabream, although mullet and common seabream were also produced. The total pond water surface area reported was 762 ha. Average production has been around 2 000 tonnes, and in 2024 it was 2 020 tonnes. Farmers reported that, on average, 10 percent of the fish in semi-intensive culture systems are killed annually by cormorants. In extensive open-water culture systems without nets, up to 87 percent of fish are killed annually by cormorants, making open-water culture no longer economically feasible in some cases.

In 2024, the average value of fish consumed per cormorant in extensive culture systems was estimated at EUR 1.13 per day, while in semi-intensive systems, the corresponding value was EUR 3.3 per day. In addition to direct fish losses from cormorant predation, an estimated 15 percent of harvested fish in semi-intensive culture systems showed damage from cormorant attacks, including scars, malformations and infections. Such damage reduces the market value of the fish because they can no longer be sold whole. The total cost of cormorant predation in 2024, as estimated by the 12 fish farmers, amounted to EUR 1.048 million. The average cost of cormorant predation in 2024 was EUR 1 375 per hectare of fish pond. Given that Andalusia has about 3 200 ha of coastal pond farms, the total cost of cormorant predation to aquaculture production in the region can be conservatively estimated at around EUR 4 million per year.

The Andalusian fish farmers received compensation amounting to EUR 224 000 in 2024 for cormorant-related predation losses. The number of derogations granted for culling cormorants in 2024 is unknown, but the farmers reported that 239 birds were culled. Costs incurred for watchkeeping, nets and cartridges for shooting are not included in the above calculations.

FEAP members in Spain reported predation damage at 9 fish farms in 2024, ranging from EUR 300 to EUR 39 000; associated costs up to EUR 8 330 were reported in the same year (Table 2).

Table 2. Reported predation-related damage and costs caused by cormorants on individual fish farms in various other regions of Spain, 2024

Farm	Main fish species cultured	Non-breeding cormorant population (2024)	Occurrence in the year (days)	Estimated daily fish consumption (EUR)	Estimated damage in 2024 (EUR)	Other costs (nets, sound devices)
1	Carp	70	180	2.17	27 342	1 245
2	Carp	60	180	2.17	23 436	4 500
3	Carp	100	180	2.17	39 060	8 330
4	Carp	93	140	2.17	28 253	525
5	Trout	60	180	2.50	27 000	No information
6	Trout	2	60	2.50	300	No information
7	Trout	40	90	2.50	9 000	No information
8	Trout	10	90	2.50	2 250	No information
9	Trout	155	90	2.50	34 875	No information

Source: Farm survey reports submitted to FEAP in May 2025.

Herons and otters also preyed on fish on some of these farms, and the related losses and damage could be substantial.

In Asturias, in northwest Spain, aquaculture farmers reported that 900 cormorants wintered in the region in 2024 for approximately 160 days and consumed an estimated EUR 360 000 worth of fish, cockles and other bivalves. In addition, diet analysis showed the presence of salmonids in 63 percent of cormorant pellets, with estimated consumption rates of 250–350 g per day and total predation amounting to several tonnes of salmonids, including Atlantic salmon.

No compensation was paid or made available for losses.

Information is not available for Spain regarding damage to inland and coastal fisheries resources caused by cormorant predation on fish.

References

EEA (European Environment Agency). 2020. *Article 12 web tool: bird species distribution and trends (2013–2018 reporting)*. Brussels. [Cited 21 April 2026]. https://nature-art12.eionet.europa.eu/article12

MAF (Ministerio de Agricultura, Pesca y Alimentación). 2024. *Datasheets on predation reports by aquaculture facilities in Spain*. Statistical Service, Ministry of Agriculture, Fisheries and Food, Madrid.

Sweden

Information was received from the Swedish Board of Agriculture, the Swedish Agency for Marine and Water Management, and the Swedish Environmental Protection Agency.

In 2023, the Swedish University of Agricultural Sciences (SLU), on behalf of the Swedish Environmental Protection Agency, conducted a nationwide inventory of breeding great cormorants in Sweden. The inventory recorded 74 767 breeding pairs (nests) in 224 colonies, compared with 40 958 nests in 169 colonies in 2012. Great cormorants bred in all counties except Jämtland and Dalarna. The number of colonies and nests increased in most counties, particularly in Kalmar, Blekinge, Västra Götaland and Östergötland. The majority of breeding cormorants – more than 64 000 nests in 147 colonies – were found in coastal environments, while approximately 10 000 nests in 77 colonies were located in freshwater environments (Lundström, 2024; Swedish Environmental Protection Agency, 2024).

The Swedish Board of Agriculture estimates that two young birds fledge per nest. On this basis, each nest corresponds to four individuals, giving an estimated total of 299 068 great cormorants in Sweden in 2023. The size of the wintering population is unknown.

Applying the nest count and the estimated total population to an indicative estimate of damage caused by the great cormorant population to fish, fisheries and aquaculture in Sweden results in an estimated annual damage of EUR 80.6 million (Table 1). This amount is likely to be an underestimate.

Table 1. Estimated damage caused by cormorants to fish, fisheries and aquaculture in Sweden, 2023

Species	Category	Individuals in 2023	Occurrence in the year (days)	Estimated damage in 2023 (EUR)
Great cormorant	Breeding population*	149 534	180	67 290 000
Great cormorant	Non-breeding population**	149 534	90	13 458 000

*The available literature indicates that breeding cormorants in Sweden are typically present from March until the autumn migration in September–October, corresponding to roughly 180–240 days per year for most birds. However, an unknown but apparently increasing proportion overwinters in southern Sweden, so some individuals may be present year-round (Lundström *et al*., 2024).
**The non-breeding population shown here includes only young birds fledged from their nests and assumes that they migrate after 90 days (Dewey, 2009). An average daily fish consumption value of EUR 2.5 per bird was applied because a more detailed estimate was unavailable.

In 2023, Sweden reported culling 17 704 cormorants. Of these, 14 401 were hunted under permits issued by the County Administrative Boards and 3 303 were culled in accordance with the Swedish Hunting Ordinance. In 2023, the County Administrative Boards authorized the culling of 21 554 cormorants. Under the Hunting Ordinance, hunting for the purpose of preventing serious damage is also permitted under certain conditions and without a maximum limit. Protective hunting carried out on individual initiative can be reported through the Viltdata application, which is provided by the Swedish Association for Hunting and Wildlife Management (Swedish Association for Hunting and Wildlife Management, n.d.; Swedish Environmental Protection Agency, 2024).

No compensation payments to fish farmers or fishers for damage caused by cormorant predation were reported for either 2023 or 2024. Nevertheless, preventive measures against cormorant predation, including protective hunting, egg oiling and scaring, were undertaken at an estimated cost of EUR 9 200 in 2023 and EUR 130 000 in 2024.

The Swedish Board of Agriculture has a system for reporting damage caused by wildlife to fishing gear and catches. The data collection system functions well, but shortcomings remain, including the need to use a common code (i.e. ROV) to report predator damage to catches when recording all damage, regardless of whether it involves seals, cormorants, otters or other predators (Swedish Agency for Marine and Water Management, 2025).

Both the Swedish Board of Agriculture and the Swedish Agency for Marine and Water Management received information from fisheries, aquaculture enterprises and County Administrative Boards indicating that inland fishers and aquaculture operators primarily experience problems with cormorants, but also with otters and herons. Coastal fishing faces many problems arising from interactions with seals. In recent decades, the conflict between seals and commercial fishing has reduced income through seals biting or removing catch from passive gear, increased the costs of damaged gear and changes in fishing methods or the use of seal-safe gear, and reduced income by increased competition for fish and lower sales caused by parasite-infected fish. Sweden therefore has better data on the costs of fishing and seals and their interactions (Gunve, 2025).

The Vättern Fishermen's Association, whose members are commercial inland fishers active on Lake Vättern, one of Sweden's largest lakes, reported that fish have left areas patrolled by cormorants. Both perch and whitefish are now found in much deeper water, at 30–40 metres, and are therefore more difficult for both cormorants and fishers to catch. When cormorants first became established around the lake, commercial fishers in Lake Vättern fished in shallow water during spring and summer. However, cormorants often bit the fish or took them out of the nets. It is believed that a similar shift of fish into deeper waters has occurred on the east coast, where perch have recently been seen largely in the outer archipelago. There is also reason to believe that the sharp decline in grayling in Lake Vättern results from the presence of cormorants (Gunve, 2025).

Some inland fishers also reported damage in recent years. The Swedish Agency for Marine and Water Management and the Swedish Board of Agriculture compiled data on reported damage from inland fishers, although the data remain incomplete because not all inland fishers report wildlife-related damage. Damage reported by inland fishers operating in lakes generally refers to cormorant damage (Table 2). Damage reported by fishers active in rivers or estuaries, which are classified as freshwater areas, may also have been caused by seals (Gunve, 2025).

Table 2. Reported catch damaged by predators in Lakes Hjälmaren, Mälaren, Vänern and Vättern, Sweden, 2023 and 2024

Species/item	Hjälmaren	Mälaren	Vänern	Vättern	Total kg	Total number (not kg)
2023						
Abborre	81	21	8	1	111	-
Björkna	4	-	-	-	4	-
Braxen	276	5	46		327	-
Faren	8	-	-	-	8	-
Gädda	217	22	19	-	258	-
Gös	1 627	525	54	-	2 206	-
antal ej kg	-	-	5	-	-	5
Lake	2	14	-	1	17	-
Lax	-	-	1	-	1	-
antal ej kg	-	-	4	1	-	5
Sikfiskar	-	-	-	1	1	-
Siklöja	-	90	1 150	-	1 240	-
Ruda	40		-	-	40	-
Ål, blankål	10	195	4	-	209	-
Ål, gulål	1	-	-	-	1	-
Öring	-	-	-	-	-	-
antal ej kg	-	-	1	-		1
2024						
Abborre	55	40	231	31	357	-
Braxen	390	20	-	-	410	-
Gädda	62	62	58	-	182	-
Gös	778	503	41	3	1 325	-
Lax	-	-	-	1 564	1 564	-
Mört	-	-	60	-	60	-
Sikfiskar	-	-	180	33	213	-
Siklöja	-	172	8 740	-	8 912	-
Ål, blankål	5	234	50	-	289	-
Öring	-	-	8	15	23	-

Note: Species names are reproduced as reported in the source data. The term “antal ej kg” indicates records reported as numbers rather than weight. The table reflects reported predator-damaged catches and may underestimate total damage because reporting is incomplete.

Sweden's National Management Plan for the Great Cormorant (2023) sets out the country's approach to balancing conservation with conflict mitigation. It aims to maintain a viable population while reducing impacts on fisheries through ecosystem-based, adaptive management. The plan promotes regional responsibility, stakeholder collaboration, monitoring, and measures such as protective hunting and deterrence to minimize damage and support informed decision-making (Swedish Environmental Protection Agency and Swedish Agency for Marine and Water Management, 2023).

References

Dewey, T. 2009. *Phalacrocorax carbo* (great cormorant). Animal Diversity Web. University of Michigan. [Cited 21 April 2026]. https://animaldiversity.org/accounts/Phalacrocorax_carbo

Gunve, E. 2025. *Sweden's report to EIFAAC, EAA and FEAP for the European inventory of fish damages caused by cormorant predation: background and a quick survey*. Swedish Board of Agriculture.

Lundström, K. 2024. Rikstäckande inventering av häckande storskarv (*Phalacrocorax carbo*) i Sverige 2023. *Aqua notes*, 2024(7). Uppsala, Sweden, Swedish University of Agricultural Sciences. https://doi.org/10.54612/a.6tcqoqona2

Lundström, K., Ovegård, M., Karlsson, M., Bergström, U., Lövgren, J., Sandström, A., Sjöberg, N., Sundblad, G., Säterberg, T., Wennhage, H. & Östman, Ö. 2024. Storskarvens (*Phalacrocorax carbo*) ekologi, roll i ekosystemet och effekter på fiskpopulationer: en sammanställning av kunskap och kunskapsbehov. *Aqua reports*, 2024(9). Lysekil, Sweden, Institutionen för akvatiska resurser, Sveriges lantbruksuniversitet. https://doi.org/10.54612/a.300f4oihko

Swedish Agency for Marine and Water Management (Havs-och vattenmyndigheten). 2025. Sälpopulationernas tillväxt och utbredning samt effekterna av sälskador i fisket och sälarnas roll i ekosystemet. *Havs-och vattenmyndighetens rapport*, 2025:2. Gothenburg, Sweden. [Cited 21 April 2026]. https://www.havochvatten.se/data-kartor-och-rapporter/rapporter-och-andra-publikationer/publikationer/2025-01-23-salpopulationernas-tillvaxt-och-utbredning-samt-effekterna-av-salskador-i-fisket-och-salarnas-roll-i-ekosystemet.html

Swedish Association for Hunting and Wildlife Management (Svenska Jägareförbundet). n.d. *Hunting in Sweden*. [Cited 21 April 2026]. https://jagareforbundet.se/huntinginsweden

Swedish Environmental Protection Agency (Naturvårdsverket). 2024. Large increase in great cormorant in Sweden. *News article*, 21 March 2024. Stockholm.

Swedish Environmental Protection Agency (Naturvårdsverket) and Swedish Agency for Marine and Water Management (Havs-och vattenmyndigheten). 2023. *Nationell förvaltningsplan för storskarv*. Stockholm. [Cited 21 April 2026]. https://www.naturvardsverket.se/4ade7d/globalassets/amnen/jakt-och-vilt/dokument/nationell-forvaltningsplan-for-storskarv-2023.pdf

Switzerland

Information was received from the Swiss Federal Office for the Environment (BAFU) and Schweizerischer Fischerei-Verband (or SFV, the Swiss Fishing Association).

The report on cormorant breeding in Switzerland indicated a continued increase in breeding pairs of great cormorants in 2023 (Müller, 2024). The national breeding population rose from 3 438 pairs in 2022 to 3 607 pairs in 2023. Growth was uneven across regions: numbers declined at Lake Neuchâtel, remained stable at Lake Geneva, and increased significantly at Lake Constance. Some colonies expanded strongly, while others disappeared, resulting in a slight decrease in the total number of occupied colonies. Long-term trends illustrated in the report show a substantial increase in breeding pairs across Switzerland, reflecting sustained population growth despite regional fluctuations and local redistribution of colonies. The number of breeding pairs continued to increase in 2024, reaching 3 704 (Wechsler *et al*., 2025).

The wintering population counted in January 2023 for Switzerland, including the foreign parts of Lake Constance and Lake Geneva, was 11 922 great cormorants (Schweizerische Vogelwarte, 2024), of which more than 10 000 were counted in natural reserves.

The value of average fish consumption per cormorant per day was estimated at EUR 2.50. On this basis, the estimated value of fish consumed by great cormorants in Switzerland has been around EUR 4.3 million annually in recent years (Table).

Legal note: In the Swiss context, broad estimates of damage to fish stocks are not legally recognized and therefore are not reported as damage. Under Swiss law, uncaught fish are considered *res nullius* (ownerless) and do not legally belong to anyone. Therefore, if they are eaten – by cormorants or otherwise – no legal damage is incurred.

Table. Estimated damage caused by fish predators in Switzerland

Species	Category	Individuals in 2023	Individuals in 2024	Occurrence in the year (days)	Estimated damage in 2023 (EUR)**	Estimated damage in 2024 (EUR)**
Great cormorant	Breeding population	7 214	7 408	180–220	0	0
Great cormorant	Non-breeding population*	11 922	No information	120–150	0	0

* Switzerland is located on a migration route of cormorants, which means that the number of cormorants in autumn (October–November) is often higher than in January (wintering population) (Schifferli, Burkhardt and Kestenholz, 2005; Schweizerische Vogelwarte, n.d.).
** In the Swiss context, broad estimates of damage to fish stocks are not legally recognized and therefore not reported as damage. Under Swiss law, uncaught fish are considered *res nullius* (ownerless) and do not legally belong to anyone.
Sources: Müller, 2024; Schweizerische Vogelwarte, 2024; Wechsler *et al*., 2025.

Predation by cormorants on threatened fish species in rivers is a reason for culling and deterrence in Switzerland. Culling and deterrence measures are allowed by cantonal and federal offices and are often implemented to protect threatened fish species in certain rivers in the country.

Two cantons, Ticino and Graubünden, reported that cormorants affect fish and fisheries and provided value estimates of damage caused. These estimates amounted to hundreds of thousands of euros in Ticino but were minimal in Graubünden. In 2023, Ticino issued 27 permissions for hunting cormorants

and reported that 65 birds were culled. In 2024, 22 cormorants were culled in Graubünden. In Graubünden, the impact on fish stocks caused by grey herons (*Ardea cinerea*), which breed in the canton, and otters is considered greater than the impact of cormorants.

The Swiss Federal Office for the Environment (BAFU) also contacted fish farms about damage caused by cormorants. The fish farms did not report damage caused by predation by cormorants.

In 2024, the fisheries commission for Lake Neuchâtel issued a study on commercial fisheries and great cormorants (Pêche professionnelle & Grand Cormoran – Évaluation des dommages à la pratique de la pêche professionnelle). The study evaluated the economic impacts of great cormorant predation on commercial fisheries in Lake Neuchâtel. It documents substantial losses due to fish being consumed, injured or removed from fishing gear, as well as additional costs from damaged nets and reduced fishing efficiency. Over the period 2009–2023, estimated annual economic losses, including fish and gear damage, ranged from approximately CHF 143 000 to CHF 286 000, equivalent to about EUR 294 000 and corresponding to around 4–5 percent of the total annual fishery value. Fish losses alone account for CHF 118 000 to CHF 239 000 annually, equivalent to about EUR 246 000, with particularly high impacts on coregonids. Gear damage added further costs, estimated at up to CHF 47 000 per year across the fleet, equivalent to around EUR 48 000. The average value of fish landed by the 31–33 commercial fishers was estimated at approximately CHF 27 000–35 000 per tonne over the period 2009–2023, and average fish landings were around 110 tonnes annually.

Preventive measures taken by commercial fishers mainly involved adapting fishing practices, such as modifying gear type, depth and deployment periods in order to reduce accessibility to cormorants. However, their effectiveness remains uncertain, and predation appears opportunistic and difficult to control. The report further highlighted methodological challenges in quantifying total damages and emphasized the need for improved monitoring, refined estimation methods and further experimental research to better support management decisions.

Schweizerischer Fischerei-Verband shared information on the impact of great cormorants on Swiss fish stocks. Based on data from the Schweizerische Vogelwarte (Swiss Ornithological Institute), anglers have estimated that there are, on average, 9 000 great cormorants in Switzerland throughout the year, equivalent to 3 285 000 cormorant-days, and that adults and young birds together consume about 1 400 tonnes of fish annually. For comparison, annual commercial inland fisheries production in Switzerland was estimated at 1 500 tonnes in recent years and recreational catches were around 254 tonnes (Arthur, 2025).

In terms of the impact of piscivores on fish, anglers estimate that cormorants account for 60 percent, goosanders for 30 percent and grey herons for 10 percent. The fish species most affected are grayling, lake trout, streamer and some other endangered fish species. Schweizerischer Fischerei-Verband estimates the damage caused by cormorants to fish stocks in Switzerland to be more than EUR 500 000, equivalent to about 1 percent of the gross value of all fisheries, including aquaculture.

References

Arthur, R. 2025. *Status and trends of inland fisheries in Europe.* EIFAAC Occasional Papers, No. 57. Rome, FAO. [Cited 21 April 2026]. https://doi.org/10.4060/cd3884en

Commission Intercantonale de la Pêche dans le lac de Neuchatel. 2024. *Pêche professionnelle & Grand Cormoran – Évaluation des dommages à la pratique de la pêche professionnelle.* Rapport final (Aquarius). Neuchâtel.

Müller, C. 2024. *Kormoranbruten Schweiz/Nichées du Grand Cormoran en Suisse 2023.* Schweizerische Vogelwarte, Sempach.

Schifferli, L., Burkhardt, M. & Kestenholz, M. 2005. Population of Great Cormorants *Phalacrocorax carbo* wintering in Switzerland, 1967–2003, and numbers during the breeding season. *Ornithologische Beobachter*, 102: 81–96.

Schweizerische Vogelwarte. n.d. *Great cormorant (*Phalacrocorax carbo*).* [Cited 21 April 2026]. https://www.vogelwarte.ch/en/birds-of-switzerland/great-cormorant

Schweizerische Vogelwarte. 2024. *Waterbird census January 2023 for Switzerland.* Sempach.

Wechsler, S., Auchli, N., Bühler, R., Gremion, J., Kéry, M., Müller, C., Schneider, A., Strebel, N. & Varga, K. 2025. *Vogelmonitoring 2024.* Schweizerische Vogelwarte, Sempach. ISSN: 3042-7479. [Cited 21 April 2026]. https://www.vogelwarte.ch/wp-content/uploads/2025/05/Vogelmonitoring-2024.pdf

Ukraine

Information was received from the State Institution Methodological and Technological Center for Aquaculture of the State Agency for the Development of Melioration, Fisheries, and Food Programs of Ukraine under the Ministry of Economy, Environment and Agriculture of Ukraine.

No recent cormorant counts had taken place. This summary, therefore, relies on the BirdLife International (2021) data of 2014–2018, which reported 60 000–80 000 breeding pairs and a wintering population of 10 000–15 000 birds in Ukraine. Based on cormorant-days and average fish consumption values, the damages are estimated at EUR 22.1 million annually (Table 1).

Table 1. Estimates of the number of cormorants and associated damages

Category	Individuals*	Occurrence in the year (days)	Estimated damages (EUR)**
Breeding population	140 000	150	21 000 000
Non-breeding population	12 500	90	1 125 000

Source: BirdLife International (2021) averages.
*Annual estimates [averages] for the 2014-2018 are used as no new counts are available.
**The average fish price for freshwater fish (carp species) in Ukraine is approximately EUR 2/kg. Daily consumption of fish per cormorant is 0.4–0.6 kg/bird; therefore, it is estimated that a cormorant in Ukraine consumes about EUR 1 of fish per day.

Aquaculture

Aquaculture production reported in Ukraine was more than 18 600 tonnes in 2024 (FAO, 2026a). Seven aquaculture farms with pond culture of common carp, grass carp, bighead and silver carps, pike, zander, roach, perch, catfish and sturgeon reported about the predation of fish by cormorants in recent years. The seven farms, with a pond area of 1 160 ha, produced some 660 tonnes in 2025, i.e. about 600 kg/ha. The farms varied considerably in size, with the largest having 750 ha of ponds and the smallest only 4 ha. The farmers reported that 10–50 percent of their stocked fish were killed by cormorants and another 0–30 percent of fish were injured by them. The average annual income loss owing to cormorant predation of fish ranged from 15 to 55 percent. Two large farms (750 ha and 135 ha) reported annual income losses of EUR 200 000 and EUR 50 000, respectively, from fish predation by cormorants. Five of the seven farms also reported the costs of their preventive and mitigation measures to reduce cormorant predation of fish. These reported costs ranged from 100 EUR to EUR 50 000 per farm and included nets and labour costs for scaring or regulating.

Information from a rainbow trout farm with 8 to 10 cages of 300 m^3 each and an annual production ranging from 180 to 250 tonnes revealed that also cage culture farms in Ukraine are affected by cormorant predation. The farmer estimated that around 5 percent of the fish are killed by cormorants and another few percent of the fish are injured or damaged by them. The estimated income loss was difficult to assess but likely more than EUR 25 000 per year, as off-farm prices of rainbow trout in Ukraine can exceed EUR 5/kg. In 2025, the cage culture farmer spent EUR 4 500 on nets for cages.

As reported by pond farmers, more than 85 percent of Ukraine's aquaculture production is pond based (FAO, 2026b), and average fish losses attributed to cormorant predation were approximately 30 percent. At an off-farm price of EUR 2/kg, a conservative estimate of the predation damage caused by cormorants to the pond aquaculture sector in Ukraine is EUR 11 million per year (Table 2). The annual damage caused by cormorant predation to trout farming businesses could also add up to more than EUR 0.5 million.

Compensation

No national compensation scheme exists for damages caused by cormorant predation to aquaculture.

Table. Off-farm fish prices in Ukraine in 2025

Main fish species cultured	Average off-farm price (EUR/kg)
Common carp	2.0
Bighead and silver carp	1.2
Grass carp	2.1
Crucian carp	1.0

Source: State Institution Methodological and Technological Center for Aquaculture.

References

BirdLife International. 2021. *European Red List of Birds*. Luxembourg, Publications Office of the European Union.

FAO. 2026a. Fishery and Aquaculture Country Profiles. Ukraine, 2019. Country Profile Fact Sheets. In: *Fisheries and Aquaculture*. [Cited 23 April 2026]. https://www.fao.org/fishery/en/facp/UKR

FAO. 2026b. Ukraine. Text by Bekh, V. In: *Fisheries and Aquaculture*. [Cited 23 April 23 2026].

United Kingdom of Great Britain and Northern Ireland

Information was received from the Angling Trust and Salmon Scotland. No information was provided by the Department for Environment, Food and Rural Affairs. The Department expressed "concerns about the chosen model for the inventory, since it seems to imply that every bird in the local population feeds inland which isn't necessarily the case. It also risks oversimplifying the relationship between cormorant numbers and monetized impacts of estimated predated fish".

The wintering population of the great cormorant in the United Kingdom was estimated at approximately 45 000 individuals in January 2018, increasing to around 60 000–65 000 individuals at peak winter abundance (Frost *et al*., 2019). No updated national census of breeding great cormorant pairs has been published by the Joint Nature Conservation Committee (JNCC) since the Seabirds Count (2015–2021) assessment. The number of cormorant breeding pairs reported in the census was 9 500. More recent JNCC outputs provide population indices and trend data up to 2023/2024, indicating a broadly stable great cormorant population with recent levelling off, but do not include revised absolute breeding population estimates (Frost *et al*., 2026). Breeding cormorants in the United Kingdom are predominantly resident, remaining within the country year-round (~365 days), although colony attendance is concentrated during the breeding season (approximately five–six months).

By multiplying the cormorant days with the average daily value of fish consumed by cormorants, the rough estimate of damages caused by cormorants to fish, fisheries and aquaculture in the United Kingdom amounts to EUR 40.1 million per year (Table 1).

Table 1. Estimates of the number of cormorants in the United Kingdom and damages caused

	Individuals	Occurrence in the year (days)	Estimated damages caused per year (EUR)**
Great cormorant Breeding population*	19 000	365	17 337 000
Non-breeding population	45 000	210	23 625 000

*Consisting of 7 500–8 500 breeding pairs of *Phalacrocorax carbo* and 1 000–1 500 breeding pairs of *Phalacrocorax carbo sinensis*.

**The value of daily fish consumption was estimated at EUR 2.50/cormorant. This value was based on FAO fish price averages for 2023/2024 and applied by most countries in this study.

Sources: Cormorant breeding numbers originate from the Joint Nature Conservation Committee latest assessment (2015–2021), and wintering numbers are from Frost *et a*l., 2019.

Recreational fisheries

The Angling Trust, representing over 2 300 affiliated angling clubs, fisheries and related organizations, reported that the salmon smolt is probably the most threatened fish species by predation, as the smolts are being targeted by both cormorants and goosanders (and seals). Reference was also made to Russell *et al*. (2021), stating that predation pressure, especially by piscivorous birds, on brown trout and roach has increased considerably in recent decades in the United Kingdom and Wales.

The Angling Trust collaborates with the Government of the United Kingdom and supports the area-based licences (ABLs), which can cover large river catchments. In 2025–2026, they issued 20 ABLs with 440 volunteers carrying out non-lethal or lethal techniques. They also administer the licensing conditions and reported culling. This equates to 3 hours per week per volunteer. The total number of volunteer hours per year is around 68 640, which at EUR 25/hour equates to EUR 1.7 million. This value can also be multiplied to account for individual volunteer hours (Table 2). The total value of

volunteer hours spent on regulating cormorants in the United Kingdom can be estimated at EUR 3.5 million/year.

Table 2. Cormorant licences issued in the United Kingdom (2022–2025)

Season	Licences issued (individual)	Licences issued (area-based)	Combined total licences issued	Birds licensed (individual)	Birds licensed (area-based)	Total number birds licensed (Indiv + ABL)	Birds shot (individual)	Birds shot (area-based)	Total number birds shot (Indiv + ABL)
2022/23	326	24	350	1 742	619	2 361	1 433	449	1 882
2023/24	382	23	405	2 110	699	2 809	1 597	604	2 201
2024/25	407	23	430	2 224	670	2 894	1 843	592	2 435

Note: Indiv = individual; ABL = area-based licenses.
Source: The Angling Trust administration (2026) - information received via e-mail.

Aquaculture

Salmon Scotland represents the Scottish salmon farming sector, comprising approximately seven producer companies (farmers) and around 45 member organizations across the wider aquaculture supply chain. This organization reported that cormorants do not cause the sector any particular issue different from that of any other predator. The predator exclusion methods work effectively to minimize any impacts. These exclusion methods include a primary net in the water (nets are now typically all made of high-density polyethylene, or being transitioned to that) and the top net. Top nets are deployed through either "hamster wheel" systems, which have a structure in the centre of the pen over which the net is placed, or "pole-mounted" systems, which have high poles at the edge of the pen and the net stretched across it. The farmers practice regular removal of salmon mortalities to help avoid attracting predators. They recognize that cormorant predation is affecting freshwater pond systems and river fish stocks that cannot be protected by nets.

Compensation

No dedicated national compensation scheme for cormorant predation damage to fisheries or aquaculture has been identified in the United Kingdom in recent years. Management responses rely primarily on derogation-based control and mitigation measures.

References

Frost, T., Austin, G., Hearn, R., McAvoy, S., Robinson, A., Stroud, D., Woodward, I. & Wotton, S. 2019. Population estimates of wintering waterbirds in Great Britain. *British Birds*, 112: 130–145.

Frost, T.M, Calbrade, N.A., Birtles, G.A., Feather, A., Hiza, B.M., Caulfield, E.B., Balmer, D.E., Peck, K., Wotton, S.R., Shaw, J.M. & Woodward, I.D. 2026. *Waterbirds in the UK 2024/25: The Wetland Bird Survey and Goose & Swan Monitoring Programme*. BTO/RSPB/ JNCC/NatureScot.

Russell, I.C., Cook, A.C., Ives, M.J. & Davison, P.I. 2021. The diet of two sympatric great cormorant *Phalacrocorax carbo* subspecies wintering at freshwater fishery sites in England and Wales. *Ardea* 109, 443–456. https://doi.org/10.5253/arde.v109i2.a15

Annex 2 Survey questionnaire: angling organizations

Questionnaire to angling organizations – damage by cormorants 2023, 2024

Please fill in this questionnaire. For fields you have no data, just write NA (not available).

Your country/region:
Your water area (in hectares):

Predator impact: **cormorants and other predators = 100%**	**2023**	**2024**
Number of cormorants		
Breeding pairs (if any): Nests counted (= breeding pairs):		
Estimated cormorant days (per year): Nesting birds **+ non-breeders**/(1.5 birds per nest)		
Visiting birds from other countries: (Eventually give an estimate for the month with the highest number and the month with the lowest number – winter/spring).		
Other predators: Names:		
Predator impact on fish, in percentages: Cormorants: Other predators: = 100		
Which fish species are threatened by cormorants? Nationally? Locally?		
Economic impact:		
What is the damage cost in euros? Please include the cost for scaring, monitoring, restocking, loss of club members, loss of fees, etc. (include other costs if any). Please estimate or reference a national cost figure, eventually accompanied by one or more local figures/cases.		
References to relevant studies:		
Other information you find relevant for this survey? Please answer here:		

Annex 3 Predator damage data entry sheet: aquaculture and fisheries

Data entry sheets on damage caused by fish predators (2023, 2024)

DATA ENTRY SHEET

on damage caused by fish predators in [insert area]

Animal	Number A of individuals	Occurrence B days in the year	Damages C caused in Euro	Compensation paid in 2023 in Euro *	Number of hunted birds	Permissions given for culling (number of birds)
Great cormorant:						
a) breeding population (= number of nests x 2)			**0**			
b) non-breeding population			**0**			
Other animals						
Pygmy cormorant			**0**			
Heron			**0**			
Otter			**0**			
** Amount of funds (compensation for damages) transferred to the applicant's account in 2023*						
Notes (comments)						

Calculation of the average amount of damage: **C = A x B x daily damage**

Animal	Average consumption of fish in kg/day	Average price consumed fish in Euro/kg	Corrective (stress) factor	daily damage Euro/pieces
Great cormorant	**0.50**	**4.00**	**1.25**	**2.50**
Pygmy cormorant	**0.30**	**6.00**	**1.25**	**2.25**
Heron	**0.20**	**4.80**	**1**	**0.96**
Otter	**0.80**	**3.50**	**1.9**	**5.32**

Notes (comments)

Other costs made in 2023 (please insert other costs that are related to the cormorant conflict/predation by cormorants)

Cost item	Estimated costs in euro

Data entry sheet on historical damage and losses to farms due to cormorant predation

DATA ENTRY SHEET

on historical damage and losses due to cormorants predation

Closed aquaculture farms as a consequence of cormorant predation

Name of farm	Location	Year of closure	Pond area in hectares	Main species cultured	Average production per year in tonnes*	Average farm income per year in Euros*

** in years that the farm operated normally*

Notes (comments)

Fish losses at active farms due to cormorant predation

Name of farm	Location	Pond area in hectares	Main species cultured	Average production per year in tonnes	Percentage of fish killed by cormorants	Percentage of fish damaged by cormorants	Average estimated farm income loss from cormorant predation in Euros

Data entry sheet on closed fisheries as a consequence of cormorant predation

DATA ENTRY SHEET

on historical damage and losses due to cormorants predation

Closed fisheries as a consequence of cormorant predation

Name of water body**	Location	Year of closure	Water area in hectares	Main species stocked	Average annual investment in stocking in Euros*	Average harvest per year in tonnes*	Average income per year in Euros*

** in years that the fisheries operated normally*

*** reservoir, lake, river, canal, wetlands area*

Notes (comments)

Notes sheet provided along with the Excel data entry sheets

1.	**Number of individuals:** Average number counted (or estimated based on the number of nests).
2.	**Predation by other animals:** While not the main focus of our joint research, it would be valuable to collect information about predation by other animals such as herons, otters (please specify species) and pygmy cormorants. This information would be useful for comparison and for getting a more complete estimate on total fish predation.
3.	**Currency:** Please modify the currency used as needed.
4.	**Price of fish:** In case the government applies a price list of fish species (fry, fingerlings, market size fish) for damage compensation, then please use this official list. It would be appreciated if a copy of the list is submitted along with the filled Excel sheets. In case no official list exists, then please apply the notes below.
5.	**Price of farmed fish consumed:** Please insert the off-farm price of the species consumed. If various fish species are farmed, please add rows to the table, or provide the percentage of consumption of each species (if available) in the notes under the table.
6.	**Price of stocked fish consumed:** Please insert the value of stocked species consumed. This may be a combination of costs of stocked fry, fingerlings, adult fish and breeders.
7.	**Fish consumption:** Wintering population of great cormorants have an average daily food intake that is estimated at 0.5 kg/day. However, some suggest 0.62 kg/day and 0.8 kg/day. Breeding birds have an average daily food intake of 0.8 kg/day according to some studies. See Grémillet, D., Wright, G., Lauder, A., Carss, D.N. & Wanless, S. 2003. Modelling the daily food requirements of wintering great cormorants: a bioenergetics tool for wildlife management. *Journal of Applied Ecology*, 40: 266–277. 10.1046/j.1365-2664.2003.00806.x. and http://cormorants.freehostia.com/WI%20-%20CRSG/diet_foodintake.htm
8.	**Other costs:** Please include other costs in euros that can be attributed to conflicts with cormorants. Examples are loss of members, tourists and reduction in licence fees for recreational and commercial fishing. These cost can also include costs for scaring and hunting the cormorants, costs of coverage of ponds/water by nets, restocking costs and volunteer hours converted to euros.
9.	**Corrective factor:** In the context of fish health and aquaculture, a stress factor is any environmental or internal condition that disrupts the normal physiological and biochemical functions of a fish. The stress factor is applied because fish have to hide, swim fast to escape predation, get weaker, more prone to diseases and infections, and will not eat and grow slower because of stress.
10.	**Closed aquaculture farms:** Aquaculture farms which terminated their activities because they were not economically viable anymore as a result of cormorant predation. Their closing was partly or completely related to cormorant predation.

Annex 4 Tables

Table A4.1: Off-farm fish prices in Europe in EUR

ASFIS species (Name)	2020	2021	2022	2023	2024
Adriatic sturgeon	9.61	9.61	NA	NA	10.61
African sharptooth catfish	2.73	3.04	2.76	3.80	3.41
Aquatic invertebrates NEI	4.73	4.57	5.38	NA	NA
Arctic char	5.28	5.28	7.50	7.40	8.19
Asp	2.19	5.19	5.52	4.59	7.14
Beluga	6.78	6.33	6.51	8.20	6.65
Bighead carp	1.47	1.52	1.75	1.65	1.81
Black bullhead	7.17	6.60	NA	6.09	7.03
Black carp	2.14	2.70	2.61	1.35	NA
Bleak	0.85	0.81	1.04	1.67	2.51
Brook trout	5.03	5.27	5.78	6.31	6.53
Buffalofishes NEI	NA	NA	NA	1.14	NA
Burbot	2.77	6.22	8.21	7.71	8.61
Channel catfish	2.87	2.79	3.23	3.82	4.08
Chars NEI	4.49	5.46	6.35	5.75	6.68
Common carp	2.47	2.59	3.23	3.65	3.68
Crucian carp	1.68	1.55	1.66	1.73	2.03
Cyprinids NEI	2.84	2.76	3.23	3.79	4.15
Danube crayfish	1.67	1.49	3.05	4.77	6.10
Danube sturgeon(= Osetr)	5.04	5.91	6.22	6.35	6.30
Diadromous fishes NEI	4.80	NA	NA	12.83	10.37
Euro-American crayfishes NEI	4.89	4.61	5.46	6.36	6.95
European eel	10.73	11.46	12.39	12.05	13.07
European perch	6.38	6.29	7.31	6.94	7.65
European whitefish	4.21	5.32	4.33	10.22	10.66
Freshwater bream	1.66	2.61	3.17	1.19	1.65
Freshwater fishes NEI	3.37	3.20	4.63	4.51	5.01
Giant river prawn	16.53	15.82	15.38	13.33	13.14
Goldfish	0.62	0.68	0.87	1.09	1.25
Grass carp (= white amur)	2.69	2.67	3.22	3.64	3.92
Grayling	11.31	10.11	23.74	12.02	13.16
Hetero-Clarias catfish, hybrid	1.70	1.77	1.91	2.44	2.49
Huchen	17.43	13.52	16.23	18.30	19.07
Largemouth black bass	6.56	5.89	4.40	5.96	7.22
Masu (= cherry) salmon	21.89	21.14	23.74	23.12	24.06
Mississippi paddlefish	2.99	6.25	4.99	5.06	5.32
Noble crayfish	28.19	27.87	36.49	17.99	7.72
Northern pike	4.05	4.13	4.88	4.96	5.16
Ohrid trout	9.12	9.17	9.73	11.12	12.48
Orfe (= ide)	2.42	2.66	3.04	3.55	4.82
Pike-perch	7.50	7.38	7.30	6.18	4.95
Prussian carp	1.41	1.61	1.99	0.90	1.04

Table A4.1 *(Cont.)*

ASFIS species (Name)	2020	2021	2022	2023	2024
Rainbow trout	4.18	4.31	4.90	5.84	6.21
Red claw crayfish	NA	5.82	6.45	6.41	6.64
Roach	2.81	1.52	2.55	2.56	3.26
Roaches NEI	3.32	3.01	3.03	3.53	3.18
Rudd	2.33	0.48	0.55	0.63	0.87
Salmonoids NEI	9.10	9.53	6.42	10.35	11.53
Sea trout	6.43	6.67	6.96	7.03	7.65
Siberian sturgeon	6.62	6.83	7.78	7.15	6.89
Silver carp	2.18	2.15	2.51	2.85	3.18
Silver, bighead carps NEI	0.83	0.85	1.10	1.12	1.24
Starry sturgeon	6.12	6.11	NA	NA	NA
Sterlet sturgeon	6.17	6.54	7.07	5.84	6.90
Striped bass, hybrid	5.78	7.13	7.38	6.39	7.91
Sturgeons NEI	8.39	8.14	9.67	11.19	11.53
Tench	3.92	4.10	4.33	4.97	5.05
Trouts NEI	4.48	3.64	4.66	5.36	5.54
Wels (= som) catfish	4.15	4.64	5.39	6.64	6.12
Whitefishes NEI	3.33	3.22	3.77	4.39	4.74

Note: NA = not available. NEI = Not elsewhere included.
Note: Average off-farm fish prices provided by Member countries to FAO in USD. Average annual USD-EUR exchange rates applied from the European Central Bank.
Source: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ*. Available at www.fao.org/fishery/en/statistics/software/fishstatj.

Table A4.2: Freshwater aquaculture production by European country in tonnes, 2020–2024

Country (Name)	2020	2021	2022	2023	2024
Albania	1 612	1 861	1 316	1 361	584
Austria	4 527	4 875	4 696	5 141	4 983
Belgium	209	223	243	261	253
Bosnia and Herzegovina	3 655	3 683	3 810	3 951	4 822
Bulgaria	10 855	10 381	7 611	8 809	9 987
Croatia	2 732	4 143	4 117	3 677	4 427
Czechia	20 401	20 991	19 259	18 613	18 685
Denmark	34 076	20 612	17 621	16 355	11 018
Estonia	966	581	506	643	615
Finland	3 230	2 972	3 301	3 228	4 200
France	43 092	40 295	39 283	36 374	43 767
Germany	18 693	18 294	17 833	16 848	16 669
Greece	2 401	2 626	2 407	2 891	2 759
Hungary	18 436	18 025	18 557	17 785	19 435
Iceland	490	951	1 131	441	200
Ireland	604	537	398	488	500
Italy	36 518	44 285	32 639	37 579	33 426
Latvia	717	901	870	784	742
Lithuania	4 477	5 135	4 859	4 258	4 440
Luxembourg	8	8	8	8	8
Montenegro	537	561	721	973	1 096
Netherlands	4 860	4 820	4 670	4 770	5 080
North Macedonia	1 634	1 661	1 814	1 873	2 337
Norway	634	903	1 031	1 433	1 174
Poland	45 418	39 610	42 202	40 667	43 554
Portugal	914	867	423	317	209
Republic of Moldova	12 600	12 905	12 910	14 245	12 757
Romania	12 371	11 713	11 211	11 264	10 058
Serbia	6 710	8 008	6 576	6 606	6 870
Slovakia	2 296	2 514	2 614	2 768	2 445
Slovenia	1 169	1 175	1 022	832	937
Spain	16 292	18 508	16 896	17 952	17 516
Sweden	8 690	11 303	8 981	9 154	8 700
Switzerland	2 179	2 184	2 320	2 384	2 284
Türkiye	128 236	136 042	146 083	156 768	171 382
Ukraine	18 583	16 903	14 651	15 292	18 642
United Kingdom	9 142	9 459	8 663	7 399	6 813
Total	**479 966**	**480 517**	**463 253**	**474 192**	**493 372**

Source: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ.* Available at www.fao.org/fishery/en/statistics/software/fishstatj.

Table A4.3: Freshwater aquaculture production by European country in value (× 1 000 EUR), 2020–2024

Country	2020	2021	2022	2023	2024
Albania	4546	6 080	4 975	6 015	2 028
Austria	30 253	33 055	32 141	36 948	37 212
Belgium	1 394	1 447	1 740	1 832	2 014
Bosnia and Herzegovina	11 443	9 899	13 847	14 902	22 372
Bulgaria	33 119	33 180	27 949	38 796	48 538
Croatia	6018	9 210	10 602	13 493	15 060
Czechia	39 905	43 508	48 480	53 500	54 130
Denmark	118 058	68 576	71 551	72 518	53 472
Estonia	3 804	3 014	3 401	4 315	4 923
Finland	13 169	13 931	19 467	18 711	23 035
France	163 346	167 473	129 054	184 026	227 655
Germany	85 739	88 726	96 490	99 052	96 418
Greece	9 626	10 488	10 049	14 231	14 195
Hungary	35 550	38 507	54 285	61 355	61 826
Iceland	1 505	4 008	5 026	1 874	885
Ireland	1 884	1 761	1 234	1 516	1 561
Italy	118 867	159 155	117 398	173 674	145 834
Latvia	2 198	3 165	3 304	3 012	3 240
Lithuania	12 855	15 120	19 708	18 086	18 885
Luxembourg	29	32	25	40	43
Montenegro	1 933	2 132	3 317	4 768	6 052
Netherlands	32 350	33 412	32 600	33 850	53 699
North Macedonia	7 319	7 345	8 247	10 397	13 891
Norway	3 838	5 030	6 230	8 024	7 201
Poland	121 034	123 606	185 837	185 888	192 303
Portugal	2 681	4 988	1 399	1 186	12 399
Republic of Moldova	22 323	27 741	30 411	34 462	36 783
Romania	39 268	36 625	36 053	41 742	45 586
Serbia	16 959	19 859	24 698	29 187	28 998
Slovakia	5 606	7 190	7 861	9 714	8 628
Slovenia	4 751	5 303	5 609	4 553	5 198
Spain	56 364	66 310	68 196	83 473	87 950
Sweden	29 633	39 905	55 013	43 062	43 119
Switzerland	33 278	32 213	38 762	38 933	38 596
Türkiye	283 954	315 597	454 367	522 611	588 061
Ukraine	21 280	20 843	22 520	23 367	32 047
United Kingdom	46 867	51 779	48 014	47 535	47 723
Totals - value (EUR 1 000)	1 422 746	1 510 213	1 699 864	1 940 649	2 081 560

Note: FishStatJ data in USD have been converted to EUR applying the formal European Central Bank average annual exchange rates for 2020, 2021, 2022, 2023 and 2024.

Source: FAO. 2026. FishStat: Global aquaculture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ.* Available at www.fao.org/fishery/en/statistics/software/fishstatj.

Table A4.4: Inland capture fisheries production by European country in tonnes

Country	2020	2021	2022	2023	2024
Albania	2 844	3 544	3 388	4 858	4 505
Austria	350	350	350	350	350
Belgium	283	283	283	283	283
Bosnia and Herzegovina	300	300	300	300	300
Bulgaria	68	89	48	37	78
Croatia	415	384	362	114	97
Czechia	3 729	3 314	3 381	3 369	3 450
Denmark	40	123	93	94	94
Estonia	3 715	2 795	2 715	2 598	2 651
Finland	30 466	30 263	33 163	32 919	32 919
France	1 115	1 155	1 251	1 324	1 327
Germany	16 946	16 708	17 416	17 100	15 213
Greece	940	940	940	940	940
Hungary	5 483	4 601	4 597	4 602	4 744
Iceland	130	116	111	10	0
Ireland	85	93	93	93	30
Italy	3 800	3 800	3 800	3 800	3 820
Latvia	229	214	194	243	223
Lithuania	1 341	984	1 075	973	995
Luxembourg	0	0	0	0	0
Montenegro	145	145	145	145	145
Netherlands	1 315	1 368	1 398	1 395	845
North Macedonia	473	514	447	280	138
Norway	354	226	289	210	121
Poland	12 389	12 785	13 114	14 383	14 638
Portugal	1	0	0	0	0
Republic of Moldova	0	0	0	0	0
Romania	3 510	3 224	3 081	3 318	3 231
Serbia	1 932	2 353	2 379	2 470	2 495
Slovakia	1 736	1 815	1 895	1 656	1 516
Slovenia	155	161	158	151	118
Spain	155	302	296	170	188
Sweden	8 520	8 098	10 153	9 686	8 432
Switzerland	1 486	1 486	1 486	1 526	1 551
Türkiye	33 119	33 140	33 256	33 532	33 607
Ukraine	26 711	24 124	13 271	15 458	15 356
United Kingdom	1 066	724	452	351	190
Total	**165 346**	**160 520**	**155 380**	**158 737**	**154 591**

Source: FAO. 2026. FishStat: Global capture production 1950–2024. [Accessed on 28 March 2026]. In: *FishStatJ.* Available at www.fao.org/fishery/en/statistics/software/fishstatj.

Table A4.5: Estimated landing site value (EUR) of inland capture fisheries production by main species in Europe in 2023 and 2024

ASFIS species (Name)	2023 (EUR)	Percentage 2023	2024 (EUR)	Percentage 2024
Freshwater fishes NEI	144 008 608	20	144 818 948	20
European perch	88 245 377	12	96 486 608	13
Northern pike	51 847 333	7	50 628 109	7
Pike-perch	55 457 456	8	41 509 518	6
Common carp	33 723 268	5	32 319 591	4
Goldfish	25 616 304	4	27 805 851	4
European whitefish	26 577 357	4	26 042 625	4
Roach	17 470 169	2	22 410 461	3
Vendace	14 288 176	2	15 557 453	2
European eel	14 5461 47	2	14 416 060	2
Freshwater bream	10 416 674	1	13 931 570	2
Cyprinids NEI	8 336 950	1	9 033 295	1
Salmonoids NEI	8 490 420	1	8 886 741	1
Silver carp	7 994 283	1	8 484 375	1
Atlantic herring	451	0	8 086 240	1
Wels (= som) catfish	8 784 418	1	7 781 829	1
White bream	5 153 397	1	5 676 631	1
Roaches NEI	4 196 950	1	5 627 751	1
Euro-American crayfishes NEI	8 695 029	1	5 390 982	1
Rainbow trout	4 786 554	1	5 063 139	1
Burbot	4 238 263	1	4 836 101	1
Sea trout	5 020 352	1	4 660 152	1
Grayling	4 309 532	1	4 017 014	1
Arctic char	2 275 888	0	3 986 737	1
Crucian carp	2 340 702	0	3 521 444	0
Whitefishes NEI	3 382 634	0	3 470 744	0
So-iny (redlip) mullet	2 998 879	0	3 306 600	0
Other named species	28 214 635	4	29 540 605	4
Non-named species	125 074 360	17	131 739 440	18
Total (EUR)	716 490 566	100	739 036 615	100

Note 1: NEI = not elsewhere included.

Note 2: Off-farm fish prices have been applied for the value estimation in USD, and prices were converted to EUR using the average annual exchange rates of the European Central Bank.

Table A4.6: Freshwater pond and raceway area in Europe (by country), 2023

Country	Aquaculture pond area (hectares)	Cages and raceways (m^3 × 1 000)	Sources
Albania	200	55	FAO NASO
Austria	1 902	224	Stats reported to FAO in 2024
Belgium	40	NA	Stats reported to FAO in 2024
Bosnia and Herzegovina	1 332	NA	Stats reported to FAO in 2024
Bulgaria	10 116	1 569	Stats reported to FAO in 2024
Croatia	12 639	37	Stats reported to FAO in 2024
Czechia	41 000	NA	FAO NASO & Fuksa, 2024
Denmark	38	227	Stats reported to FAO in 2024
Estonia	178	21	Stats reported to FAO in 2024
Finland	4 997	824	Stats reported to FAO in 2024
France	68 000	NA	MedWet, 2014
Germany	20 735	2 743	Stats reported to FAO in 2024
Greece	56	31 930	Stats reported to FAO in 2024
Hungary	26 836	53	Stats reported to FAO in 2024
Iceland	0	NA	
Ireland	175	83	Stats reported to FAO in 2024
Italy	212	1 800 057	Stats reported to FAO in 2024
Latvia	5 561	29 485	Stats reported to FAO in 2024
Lithuania	10 246	225 045	Stats reported to FAO in 2024
Luxembourg	NA	NA	
Montenegro	2	8	Stats reported to FAO in 2024
Netherlands	1	NA	Stats reported to FAO in 2024
North Macedonia	9 620	133	Stats reported to FAO in 2024
Norway	NA	NA	
Poland	61 875	NA	Government data
Portugal	23	21 834	Stats reported to FAO in 2024
Republic of Moldova	51 710	NA	Stats reported to FAO in 2024
Romania	87 472	NA	FAO NASO
Serbia	5 975	76	Stats reported to FAO in 2024
Slovakia	2 609	123	Stats reported to FAO in 2024
Slovenia	426	85	Stats reported to FAO in 2024
Spain	NA	NA	Brackish in Andalusia
Sweden	NA	455	Stats reported to FAO in 2024
Switzerland	NA	NA	
Ukraine	45 000	NA	Stats reported to FAO in 2024
United Kingdom	NA	NA	
Total	**468 976**	**2 115 068**	

Note: Stats = statistics; NA = not available.

Table A4.7: Off-hatchery fry, fingerling and fish prices for key freshwater species used for aquaculture and stocking in Europe, 2022–2025

Species	Size class (EUR)	Austria (EUR)	Germany (EUR)	France (EUR)	Romania (EUR)	Hungary (EUR)	Czechia (EUR)	United Kingdom (EUR)	Poland (EUR)	Finland (EUR)
Common carp	Fry	0.06–0.30/fish	0.07–0.15/fish	0.10–0.50/fish	0.75/1 000	0.5–1/1 000	20/1 000	0.15–2/fish	1–2/1 000	NA
	Fingerlings	7.9–8.8/kg	2.5–5.5/fish	4.5–5.5/kg	2.1–4.6/kg	2.5–4.5/kg	4.8/kg	0.7–3/fish	2.5–4.5/kg	NA
	Larger fish	4.6–7/kg	4.4–10/kg	3–6.3/kg	2.3–3.95/kg	5.5–6/kg	2.6–3/kg	12–25/kg	3–5.5/kg	NA
Grass carp	Fry	NA	NA	NA	NA	NA	2–3/1 000	NA	NA	NA
	Fingerlings	3.5–7.5/fish	3.8–7/fish	2.5–4.5/kg	2–3/kg	3–5/kg	5/fish	1.5–4.5/fish	3–5/kg	NA
	Larger fish	7.5–9/kg	6.5/kg	9.5–11.9/kg	3–5/kg	5.5–6.5/kg	3–3.8/kg	7–12/kg	4–6/kg	NA
Pike-perch (zander)	Fry	1.2–2.5/fish	1.2–2/fish	NA	NA	NA	3–8/fish	NA	0.5–1.5/fish	0.2–0.6/fish
	Fingerlings	6/fish	3.8–7/fish	4–5.4/fish	3–6/fish	4–8/fish	16–18/kg	5–12/fish	4–8/fish	7–12/kg
	Larger fish	28.8–31.2/kg	26.5/kg	27–30/kg	8–15/kg	10–12/kg	14–16/kg	15–25/kg	12–18/kg	7/kg
Rainbow trout	Fry	0.08–0.25/fish	0.08–0.50/fish	0.08–0.10/fish	NA	NA	14–20/1000	145–290/1000	120–300/1 000	150–350/1 000
	Fingerlings	0.28–1.10/fish	0.60–2.50/fish	0.8–2.0/fish	NA	NA	6.8/kg	7–12/fish	5–8/kg	5–8/kg
	Larger fish	14–20/kg	6.5–9.5/kg	5.85–6.35/kg	NA	NA	5.3/kg	16–20/kg	6–10/kg	6.5–10/kg

Note: NA = not available.

Source: Collected data during the EIFAAC-EAA-FEAP survey for the inventory.

Annex 5 Damage caused by cormorants in Poland

By Igor Wawrzyniak
Department of Fisheries
Ministry of Agriculture and Rural Development

1. Literature data on losses caused by cormorants

Annual losses caused by cormorants in Poland have been estimated in the available literature in recent years at PLN 60–150 million per year (approximately EUR 14.35–35.89 million per year at the current exchange rate of EUR 1 = PLN 4.18[4]). According to a publication by scientists from the University of Warmia and Mazury in Olsztyn, Poland (Hliwa *et al*., 2018), economic losses in the Polish ichthyofauna may amount to approximately PLN 60 million (EUR 14.35 million) per year. In another publication included in the same monograph, this value was estimated at approximately PLN 60–70 million (EUR 14.35–16.75 million) per year (Zalewski, 2018). To illustrate the scale of this damage, the author explains that this value is similar to the amount of money paid for damages caused by hunted animals in all hunting districts in Poland. However, there is not any compensation available for damages caused by cormorants.

The publication by Hliwa *et al*. (2018) was based on the number of breeding and non-breeding cormorant populations estimated for 2010 by Bzoma (2011) in the most comprehensive study to date. This study inventoried the number of cormorants and attempted to outline a protection programme and a strategy for managing the cormorant population in Poland. At the same time, both authors stated that, in their opinion, the biomass of fish consumed by cormorants, estimated by Bzoma (2011) at around 12 700 tonnes (12 764 kg), is underestimated in relation to the current level, even though the draft strategy for managing the cormorant population noted that 2010 was a year affected by two relatively severe winters (2009/2010 and 2010/2011), which significantly negatively affected the number of breeding pairs in the colonies monitored at that time.

Another monograph on the economic damage caused by wild animals (Zalewski, Markuszewski and Wójcik, 2020) states that, according to various calculations, the fisheries sector loses around PLN 60–70 million (EUR 14.35–16.75 million) per year, and as much as PLN 100–150 million (EUR 23.92–35.89 million) annually, due to damage caused by cormorants. The monograph refers to the first aforementioned publication (Hliwa *et al*., 2018), but Zalewski, Markuszewski and Wójcik claim that the calculations in that study primarily concerned the cormorant breeding populations, and did not account for the non-breeding and migratory populations. Considering this, the economic damage is likely double the amount calculated.

2. Update of the valuation of losses caused by cormorants

The above-presented values of fish consumed by cormorants are significantly influenced by price inflation that has taken place in Poland in recent years. For example, the average net price of carp in 2011 was PLN 10.29/kg (EUR 2.46/kg) (Lirski and Myszkowski, 2012; this was the first year of presenting such data as part of Public Statistics). For a number of years, this price changed slightly, but in 2022 fish prices increased significantly, and the net sales price of carp reached an average of PLN 21.45/kg (EUR 5.13/kg) (Myszkowski, 2023). At that time, the industry was dealing with an exceptionally large increase in carp prices – by more than half (54.5 percent) from year to year. In 2023, a correction was made and the average price of carp, according to the preliminary valuation of Public Statistics (based on RRW-22 surveys), was PLN 20.97/kg (EUR 5.02/kg). Since 2011, the price of carp has more than doubled. Unfortunately, the fluctuations in fish prices presented in Public Statistics are

[4] Further currency conversions are based on this exchange rate: EUR 1 = PLN 4.18.

significant and include only the prices of fish originating from aquaculture. For this reason, the consumer price indices provided by the Central Statistical Office of Poland (GUS, 2024) can be considered more useful for the general valorization of the value of fish consumed by cormorants than those given in the literature. Cumulative inflation amounted to approximately 62 percent in 2010–2023, approximately 44 percent in 2018–2023, and approximately 38.5 percent in 2020–2023 .

Therefore, assuming that the value indicated by Hliwa *et al*. in 2018 (PLN 60 million ≈ EUR 14.35 million) was calculated according to 2018 prices, then already in 2023 it should be indexed by 44 percent to the level of around PLN 86 million (EUR 20.57 million). On the other hand, the value ranges given by Zalewski, Markuszewski and Wójcik in 2020 (from PLN 60–70 million ≈ EUR 14.35–16.75 million to PLN 100–150 million ≈ EUR 23.92–35.89 million) should be indexed by 38.5 percent, i.e. to the level of PLN 83–97 million to PLN 138–208 million (approximately EUR 19.86–49.76 million per year). Given that these are estimates, it can be assumed that the value of fish eaten by cormorants ranges from EUR 20 million to EUR 50 million per year.

3. Outline of the impact of cormorants on the fisheries and aquaculture economy

The above-mentioned values of fish eaten by cormorants constitute a huge burden for fisheries and aquaculture farms. It is enough to compare them with the revenues of Poland's fisheries and aquaculture sector. In 2022, the inland fisheries sector (users of fishing districts) caught only 1 680 tonnes of fish, with a gross value of around PLN 20.5 million (≈ EUR 4.90 million) (Trella *et al*., 2023). Data for 2023 indicate another historical minimum for inland fisheries catches, which amounted to 1 440 tonnes; however, the value slightly increased because of inflation, reaching approximately PLN 22 million (≈ EUR 5.26 million) (Trella, Draszkiewicz-Mioduszewska and Wołos, 2024). On the other hand, the sale of carp from large-scale carp farms generated a net revenue of about PLN 358 million in 2022 (≈ EUR 85.65 million) (Myszkowski, 2023), and in 2023 approximately PLN 371 million (≈ EUR 88.75 million) (Trella, Dubrowski and Wołos, 2024).

In addition to direct damage from cormorant predation, calculated based on the composition of food or daily food requirements and related to the number of cormorants and the season of their feeding in a given waterbody, a number of indirect damages caused by cormorants can be distinguished. In the case of aquaculture ponds, the damages are primarily the weakened condition of fish, decreased commercial value and direct or indirect fish kills, which all result from cormorant raids and the injuries they cause, including infections, severe stress and increased energy demand of fish. In fishing districts (natural waterbodies and reservoirs), the most common problems include reduced efficiency and size of catches, decreased stocking efficiency, unfavourable changes in the age structure of exploited fish species, diminished natural reproduction and recruitment, and reduced angling attractiveness of waterbodies.

Some of the problems common to both types of fish management (aquaculture and fisheries) are interdependent, and a significant cost in all cases is the protection of fish resources. However, both types of management require a different approach, at least because losses incurred in lakes and rivers are particularly difficult to calculate (Andrzejewski and Łakomy, 1998). Additionally, in the case of public waters, which are used only by entities authorized to fish, there is the issue of distinguishing losses incurred by the fishing user from those incurred by the State Treasury. There is no doubt, however, that all types of fisheries and aquaculture conducted in waters where cormorants feed struggle with economic losses and reduced revenues.

4. Dynamics of cormorant population in Poland

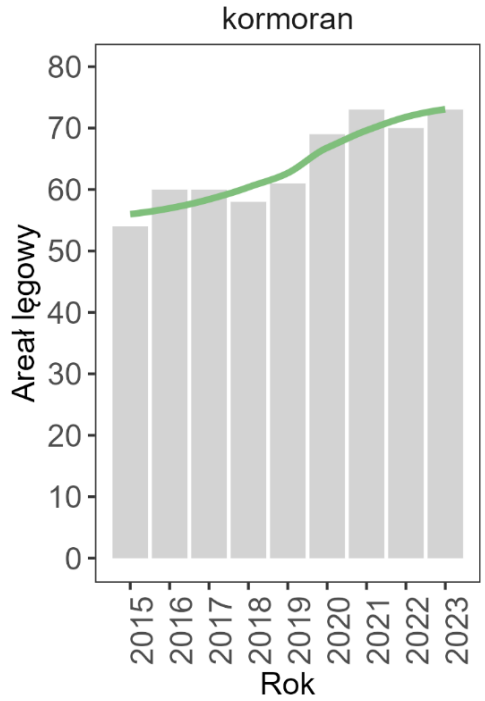
Initially, studies on the impact on fish resources and the increase in the number of cormorants in Poland focused on the phenomenon of the cormorant breeding colony in Kąty Rybackie. The birds from this colony fed mainly in the waters of the Gulf of Gdańsk and the Vistula Lagoon. Until 1994, this colony did not exceed 4 000 breeding pairs, but in the following decade it became the largest known great cormorant breeding colony in the world, reaching approximately 11 500 breeding pairs at its peak in 2004–2006 (Bzoma, 2011).

Data from the State Environmental Monitoring[5] indicate that in subsequent years there was a gradual decrease in the number of cormorant breeding pairs in the colony in Kąty Rybackie. The colony lost its status in 2019 after the number of cormorant breeding pairs decreased from 4 150 pairs to 2 800 pairs. At that time, the colony on Dębina Island on Lake Dąbie reached a record of 3 880 pairs, but in 2020 this number decreased to 2 990 pairs. As a result, in 2020, the colony on Chełminek Island in the Szczecin Lagoon became the largest cormorant colony in Poland, increasing from 2 600 pairs to 3 300 pairs. In 2020, the colony in Kąty Rybackie recorded another decline to 1 740 pairs, thus becoming smaller than the three largest colonies in the Szczecin Lagoon (Chełminek, Dębina and Gardzka Kępa) but also smaller than the largest inland colony in the Włocławek Lagoon (2 450 pairs) and reaching a level not recorded since the mid-1980s.

In 2021, after a two-year break, the largest colony in Poland was once again the colony in Kąty Rybackie, with 2 658 nests recorded. However, in 2022 and 2023, the largest colony in Poland was once again on Chełminek Island, reaching a record of 4 560 and 5 140 nests, respectively. In this way, the colony on Chełminek Island became the second-largest cormorant nesting colony in Poland's history after Kąty Rybackie, which first exceeded 4 000 and then 5 000 nests. Therefore, the largest cormorant colonies in the coastal strip moved from the Vistula Lagoon to the Szczecin Lagoon and Lake Dąbie, likely because of the limited availability of food within the colony in Kąty Rybackie. Freely migrating cormorants inhabited the most suitable nesting sites in subsequent years, colonizing new areas and thereby increasing the nesting area (Figure 1) and the population in selected colonies. Despite the fact that in 2023 as many as 4 out of 6 colonies exceeding 1 000 breeding pairs were located in the coastal zone, only 8 out of 72 colonies in total were coastal colonies (Figure 2). For this reason, out of a total breeding population of cormorants in Poland, which in 2023 amounted to 29 366 pairs, as many as 60.15 percent (17 665 pairs) nested in inland colonies, and the remaining 39.85 percent (11 701 pairs) nested in coastal colonies (Bzoma, 2023).

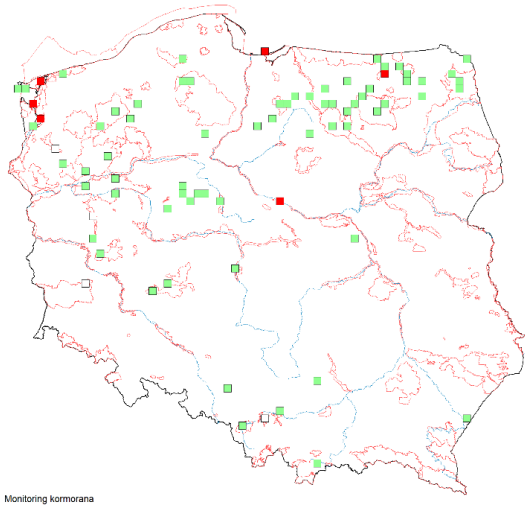
[5] The Chief Inspectorate for Environmental Protection coordinates the Polish Bird Monitoring Program as part of the State Environmental Monitoring. Since 2015, a separate Cormorant Monitoring Program (MKO) has been created within the Polish Bird Monitoring Program. This programme concerns the cormorant breeding population (https://monitoringptakow.gios.gov.pl/kormoran.html).

Figure 1. Increase in the cormorant breeding area in Poland in 2015–2023 (number of inhabited squares studied within the Cormorant Monitoring Program).



Note: The line indicates the trend fitted using the "loess" function.
Source: Bzoma, S. 2023. Monitoring Kormorana. W: Chodkiewicz Tomasz, Przymencki Marcin (red.) (2023) Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w sezonie lęgowym w 2023 roku. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. GIOŚ, Warszawa.

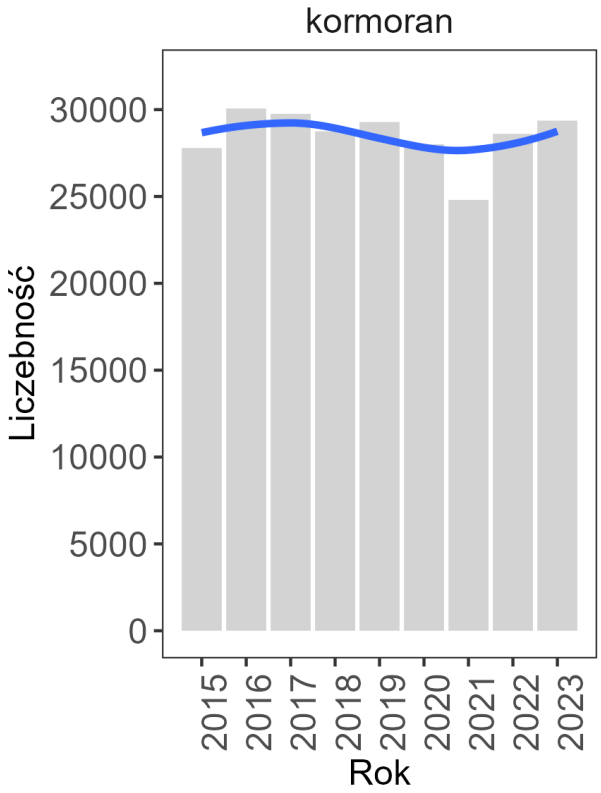
Figure 2. Distribution and population of cormorant colonies in Poland in 2023



Notes: Refer to the disclaimer on the copyright page for the names and boundaries used in this map. Empty square = no breeding; green square = 1-1 000 pairs; red square = over 1 000 pairs).
Source: Bzoma, S. 2023. Monitoring Kormorana. W: Chodkiewicz Tomasz, Przymencki Marcin (red.) (2023) Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w sezonie lęgowym w 2023 roku. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. GIOŚ, Warszawa.

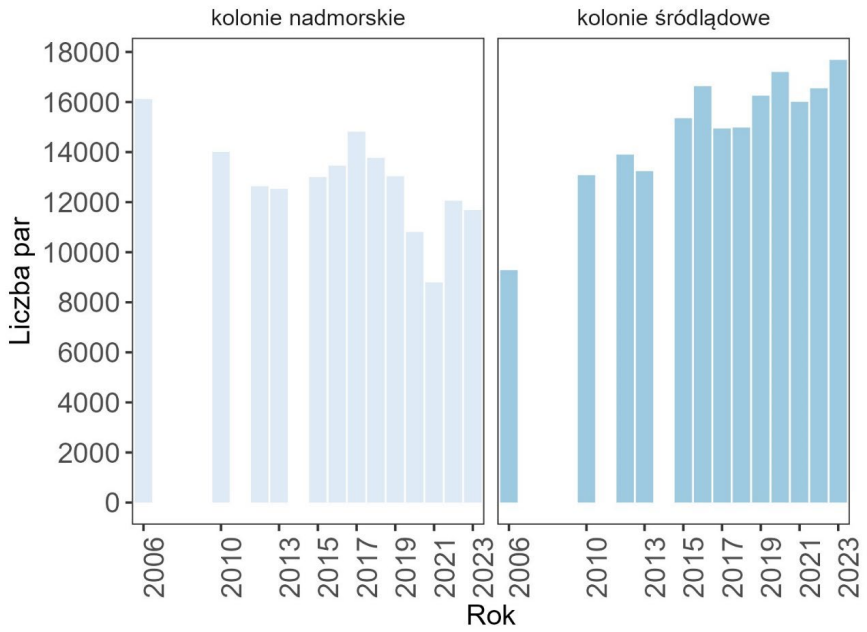
A trend observed for several years in Poland is that inland colonies have predominated over coastal ones, accounting for 60–65 percent of the total domestic breeding population of cormorants. In 2017, this share was 50 percent, and in 2006 the proportions were reversed and over 60 percent of the breeding population nested in coastal colonies. In 2006, the cormorant breeding population nested in 53 colonies and had a population of 25 795 pairs. In 2010, the majority of cormorants still nested in coastal colonies, but the number of colonies increased to 60, reaching a population of 27 108 pairs (Bzoma, 2011; Bzoma, 2023). However, the breeding population is only part of the cormorant population affecting fish resources in Poland. For this reason, according to the 2010 draft strategy for the management of the cormorant population (Bzoma, 2011), although the coastal breeding population constituted over 50 percent of the national breeding population at that time, it was estimated that cormorants feeding in marine waters (including lagoons) were responsible for only about 30–40 percent of the total fish consumption calculated during that period. Therefore, despite a similar size of the total breeding population of cormorants in the period 2015–2023 (Figure 3), there was an increase in both the number of colonies and the number of cormorants nesting in inland colonies (Figure 4 and Table 1). Thus, the overall pressure from cormorants nesting in Poland has shifted even more to inland waters.

Figure 3. Number of cormorant pairs nesting in Poland in 2015–2023



Note: The line shows the trend fitted using the "loess" function.
Source: Bzoma, S. 2023. Monitoring Kormorana. W: Chodkiewicz Tomasz, Przymencki Marcin (red.) (2023) Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w sezonie lęgowym w 2023 roku. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. GIOŚ, Warszawa.

Figure 4. Changes in the number of cormorants in coastal and inland colonies



Source: Bzoma, S. 2023. Monitoring Kormorana. W: Chodkiewicz Tomasz, Przymencki Marcin (red.) (2023) Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w sezonie lęgowym w 2023 roku. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. GIOŚ, Warszawa.

Table 1. Number of colonies, number of breeding pairs, and percentage share of the cormorant population in the inland zone and coastal zone (10 km from the Baltic coastline) in 2015–2023

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number of breeding colonies	56	60	61	58	62	70	74	72	74
Number of breeding pairs (nests)	27 789	30 066	29 757	28 751	29 289	28 007	24 802	28 607	29 366
Share of cormorant population in coastal colonies (percent)	47	45	50	48	45	39	35	42	40
Share of cormorant population in inland colonies (percent)	53	55	50	52	55	61	65	58	60

Source: Reports of the State Environmental Monitoring (PMŚ) within the framework of the Polish Bird Monitoring Program (MPP). Since 2015, a separate Cormorant Monitoring Program (MKO) has been created within the MPP monitoring system (https://monitoringptakow.gios.gov.pl).

There is no detailed knowledge about the number and pressure of the remaining part of the cormorant population in Poland after the breeding season. The cormorant population is monitored only in selected locations during bird counts conducted each January as part of the Monitoring of Wintering Waterbirds (MZPW), Monitoring of Wintering Transitional Water Birds (MZPWP), and Monitoring of Wintering Seabirds (MZPM). These counts do not provide a full picture of the situation (e.g. MZPW includes data from MZPW), but they do present a fragment of the scale of the problem. It should be noted that the cormorant was one of the most common birds in these winter censuses – both the most numerous and the most widespread. At the same time, it showed a strong increase in numbers in the period 2019–2024 (Chodkiewicz and Przymencki, 2024) (Table 2 and Figure 5). Additionally, the number of cormorants recorded in recent years during winter censuses within the MZPW (Monitoring of Wintering Waterbirds), at 33 000–52 500 individuals, is at least twice as high as the numbers of this species

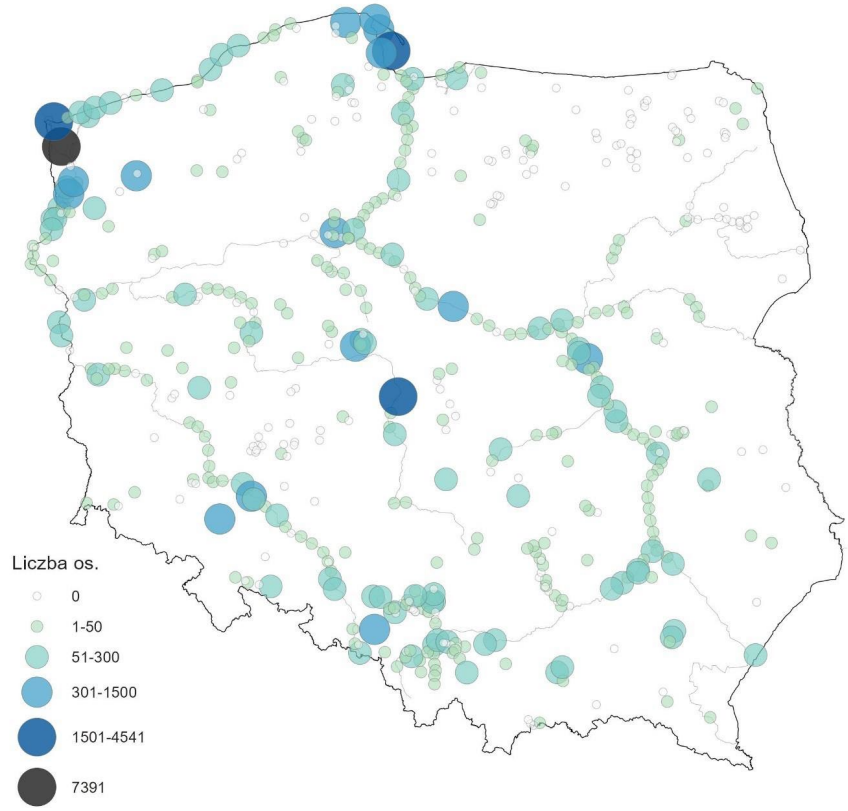
estimated for January 2010 for the draft cormorant population management strategy project (15 000 individuals) (Bzoma, 2011).

Table 2. Number of cormorants during January counts as part of the monitoring of wintering birds in 2019–2024

Year		2019	2020	2021	2022	2023	2024
Number of cormorants within the Monitoring of Wintering Waterbirds (MZPW)	Sedentary	27 926	31 474	45 168	32 256	35 975	36 221
	Flying	5 096	3 011	7 344	3 990	3 029	2 781
	Total	33 058	34 485	52 512	36 246	39 004	39 002
Number of cormorants within the Monitoring of Wintering Transitional Water Birds (MZPWP)	Sedentary	9 432	12 326	16 810	10 803	11 326	18 157
	Flying	1 811	607	834	2 759	828	1 448
	total	11 243	12 933	17 644	13 562	12 154	19 605

Source: Reports of the State Environmental Monitoring (PMŚ) as part of the Polish Bird Monitoring Program (MPP) (https://monitoringptakow.gios.gov.pl).

Figure 5. Size of cormorant assemblages in January 2024



Notes: Refer to the disclaimer on the copyright page for the names and boundaries used in this map. The total number of cormorants in the inspected sites was 36 221 "sedentary" individuals.
Source: Chodkiewicz, T. & Przymencki, M. (eds.). 2024. Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w okresie migracji i zimowania w sezonie 2023/2024. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. Etap 3. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. GIOŚ, Warszawa.

5. Difficulties in establishing a compensation system for losses caused by cormorants

In the case of losses caused by cormorants, it is difficult to apply methods used, for example, in estimating losses due to hunting or caused by beavers, where experts have direct access to destroyed crops or dykes. The methodology considered by Polish Members of Parliament (Martyniak *et al*., 2023) is not a methodological manual that could be used by the administration as a simple and quick method for calculating estimated losses incurred by specific, affected entities. It is only a starting point for indicating the method of determining certain elements of calculating losses caused by cormorants, which such a manual could contain. It focuses on the analysis of the food composition of cormorants from breeding colonies and roosting sites located on the lakes Sasek Wielki and Sasek Mały from 1 March to 31 October 2015, determining on the basis of pellet analysis the total mass of fish consumed (64.9 tonnes) and the mass of individual species (14.4 tonnes of perch, 14.3 tonnes of roach, 13.2 tonnes of tench, 9.3 tonnes of pike, and 13.7 tonnes of other species). Pellet analysis is a time-consuming method, requiring specialized knowledge and a large amount of time and work. However, a number of studies using this method can serve as a valuation model and validation of simpler methods that do not come down to a full valuation of losses but to the development of a compensation model.

Poland does not have a recognized method for a simple and quick loss assessment, neither on a national scale nor at the level of a single fisheries or aquaculture farm. The authors quoted above usually do not provide full calculations in their publications. In determining the cormorant population, they use both official data on the number of breeding pairs, published as part of the State Environmental Monitoring (PMŚ), and expert estimates regarding the remaining fractions of the cormorant population in Poland. This is because PMŚ still does not estimate the entire population of this species. There are no major reservations about the data obtained by the census method on the number and distribution of the cormorant breeding population (the number of breeding pairs and colony identification) published annually since 2015 as part of the Cormorant Monitoring Program (MKO). However, from the remaining data, it is only possible to obtain a partial picture of the number of cormorants wintering at monitoring points within three programmes conducted since 2011: Monitoring of Wintering Waterbirds (MZPW), Monitoring of Wintering Transitional Water Birds (MZPWP), and Monitoring of Wintering Seabirds (MZPM). These programmes have methodological limitations, and the data presented in them partially overlap.

For example, the Monitoring of Wintering Waterbirds (MZPW) is based on the results of a single inspection carried out in mid-January at selected sites that constitute the main wintering grounds for waterbirds in a given geographical region. The number of sites in individual regions varies and depends, among other factors, on the importance of a given area for wintering birds. The total number of sites covered by MZPW in 2011–2020 was 379, including 31 that were included in the list of sites controlled under MZPWP. In 2021, the list of controlled sites was expanded owing to increasingly milder winters and, consequently, a larger number of non-freezing sites. As a result, the results obtained began to better reflect the actual size of Poland's population of wintering waterbirds. Currently, MZPW monitoring covers 563 sites, including 39 sites that are designated as MZPWP sites. For lakes, ponds, settling ponds and coastal lagoons, the site is the entire water reservoir. However, the monitored sections of rivers and the sea coast were divided into sections of about 10 km in length, with each section treated as one object (Chodkiewicz and Przymencki, 2024). The increase in the number of objects sampled within the MZPW most likely had an impact on the higher numbers of cormorants recorded in the counts starting from 2021 (Table 2).

The described methodological limitations and gaps in data on Poland's non-breeding cormorant population have been an obstacle to creating a functional compensation system for years. It also seems that, from an economic point of view, because of the common occurrence of cormorants, a more reasonable solution is to limit the population size and reduce the losses they cause, instead of paying compensation.

The issue of damage caused by cormorants is also gaining a new context. In the case of cormorants, the focus has so far been primarily on economic conflicts and the impact of this species on the economic performance of fisheries and aquaculture farms. In recent years, problems related to the difficulties in maintaining and protecting endangered aquatic animal populations and habitats, which are affected by the spreading, extremely large population of cormorants, have been increasingly noticed and emphasized.

References

Andrzejewski, W. & Łakomy, A. 1998. Zagrożenie w gospodarce karpiowej – kormoran czarny, co dalej? W: III Krajowa Konferencja Hodowców Karpia, Kazimierz Dolny 12-14.03.1998 – Materiały konferencyjne, Olsztyn, Wyd. IRS, 1998, s. 70.

Bzoma, S. 2011. Program ochrony kormoranów Phalacrocorax carbo w Polsce. Strategia zarządzania populacją kormorana w Polsce, Warszawa Wydawnictwo Szkoły Głównej Gospodarstwa Wiejskiego (dostęp z nieaktywnego obecnie portalu: http://gatunki.sggw.pl).

Bzoma, S. 2023. Monitoring Kormorana. W: Chodkiewicz Tomasz, Przymencki Marcin (red.) (2023) Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w sezonie lęgowym w 2023 roku. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. GIOŚ, Warszawa.

Chodkiewicz, T. & Przymencki, M. (eds.). 2024. Sprawozdanie z prac terenowych i opracowanie wyników uzyskanych w okresie migracji i zimowania w sezonie 2023/2024. Monitoring ptaków z uwzględnieniem obszarów specjalnej ochrony ptaków Natura 2000, lata 2023-2025. Etap 3. Zadanie 1. Monitoring ptaków - prace terenowe i opracowanie wyników. GIOŚ, Warszawa.

GUS. 2024. Roczne wskaźniki cen towarów i usług konsumpcyjnych od 1950 r. https://stat.gov.pl/obszary-tematyczne/ceny-handel/wskazniki-cen/wskazniki-cen-towarow-i-uslug-konsumpcyjnych-pot-inflacja-/roczne-wskazniki-cen-towarow-i-uslug-konsumpcyjnych

Hliwa, P., Martyniak, A., Szymańska, U., Stańczak, K., Król, J. & Gomułka, Piotr. 2018. Wpływ kormorana czarnego (Phalacrocorax carbo) na racjonalną gospodarkę rybacko-wędkarską. W: Straty i szkody wyrządzane przez dzikie zwierzęta w gospodarce rolnej, leśnej i rybackiej, pod. red. Zalewski Dariusz. Olsztyn, Wydawnictwo Uniwersytetu Warmińsko-Mazurski w Olsztynie, s. 95-105. https://docplayer.pl/106348312-Straty-i-szkody-wyrzadzane-przez-dzikie-zwierzeta-w-gospodarce-rolnej-lesnej-i-rybackiej.html

Lirski, A. & Myszkowski, L. 2012. Produkcja rybacka prowadzona w stawach rybnych i innych urządzeniach służących do chowu lub hodowli w roku 2011 na podstawie analizy kwestionariuszy RRW-22. Badania ekonomiczne z zakresu rybactwa śródlądowego przewidziane w Programie Badań Statystycznych Statystyki Publicznej na 2011 r. (zlecone przez Ministerstwo Rolnictwa i Rozwoju Wsi). Żabieniec, Instytut Rybactwa Śródlądowego.

Martyniak, A., Hliwa, P., Szymańska, U. & Stańczak, K. 2023. Szacowanie strat powodowanych przez kormorany ponoszonych przez użytkowników wód. Maszynopis przekazany w dniu 13 kwietnia 2023 r. do Komisji Rolnictwa i Rozwoju Wsi przez Posła na Sejm RP Zbigniewa Ziejewskiego.

Myszkowski, L. 2023. Produkcja rybacka prowadzona w stawach rybnych i innych urządzeniach służących do chowu lub hodowli w roku 2022 na podstawie analizy kwestionariuszy RRW-22. Badania ekonomiczne z zakresu rybactwa śródlądowego przewidziane w Programie Badań Statystycznych Statystyki Publicznej na 2022 r. (zlecone przez Ministerstwo Rolnictwa i Rozwoju Wsi). Żabieniec, Instytut Rybactwa Śródlądowego.

Trella, M., Wołos, A., Draszkiewicz-Mioduszewska, H. & Mickiewicz, M. 2023. Gospodarka rybacka prowadzona w publicznych śródlądowych wodach powierzchniowych płynących w roku 2022 na podstawie analizy kwestionariuszy RRW-23. Badania ekonomiczne z zakresu rybactwa śródlądowego przewidziane w Programie Badań Statystycznych Statystyki Publicznej na 2022 r. (zlecone przez Ministerstwo Rolnictwa i Rozwoju Wsi). Olsztyn, Instytut Rybactwa Śródlądowego.

Trella, M., Draszkiewicz-Mioduszewska, H. & Wołos, A. (red.). 2024. Gospodarka rybacka prowadzona w publicznych śródlądowych wodach powierzchniowych płynących w roku 2023 na podstawie analizy kwestionariuszy RRW-23. Badania ekonomiczne z zakresu rybactwa śródlądowego przewidziane w Programie Badań Statystycznych Statystyki Publicznej na 2023 r. (zlecone przez Ministerstwo Rolnictwa i Rozwoju Wsi). Olsztyn, Instytut Rybactwa Śródlądowego.

Trella, M., Dubrowski, M. & Wołos, A. (red.). 2024. Produkcja rybacka prowadzona w stawach rybnych i innych urządzeniach służących do chowu lub hodowli w roku 2023 na podstawie analizy kwestionariuszy RRW-22. Badania ekonomiczne z zakresu rybactwa śródlądowego przewidziane w Programie Badań Statystycznych Statystyki Publicznej na 2023 r. (zlecone przez Ministerstwo Rolnictwa i Rozwoju Wsi). Olsztyn, Instytut Rybactwa Śródlądowego.

Zalewski, D. 2018. Dzikie zwierzęta i ich wpływ na działalność gospodarczą człowieka – odszkodowania łowieckie. W: Straty i szkody wyrządzane przez dzikie zwierzęta w gospodarce rolnej, leśnej i rybackiej, pod. red. Zalewski Dariusz. Olsztyn, Wydawnictwo Uniwersytetu Warmińsko-Mazurski w Olsztynie, s. 9-23 (https://docplayer.pl/106348312-Straty-i-szkody-wyrzadzane-przez-dzikie-zwierzeta-w-gospodarce-rolnej-lesnej-i-rybackiej.html).

Zalewski, D., Markuszewski, B. & Wójcik, M. 2020. Szkody w gospodarce wyrządzane przez dzikie zwierzęta. Olsztyn, Wydawnictwo Uniwersytetu Warmińsko-Mazurski w Olsztynie (https://wbz.uwm.edu.pl/sites/default/files/uploads/WBZ/Dokumenty/Aktualnosci/MONOGrafie_ZALEWSKI/monografia_sp_2-szkody_w_gospodarce_internet_2.pdf).

This report presents the results of a European inventory of damages and losses caused by cormorant predation to inland fisheries and aquaculture. It responds to growing concerns across Europe regarding the economic impacts of increasing cormorant populations and addresses gaps in comparable data needed for evidence-based policy development. The inventory was conducted through a joint survey by the European Inland Fisheries and Aquaculture Advisory Committee, the European Anglers Alliance and the Federation of European Aquaculture Producers, with contributions from stakeholders in 26 countries, covering 2023 and 2024. The methodology combined quantitative estimates of predation, based on bird abundance, duration of occurrence and consumption rates, with qualitative information on observed impacts, applying a harmonized valuation approach. The findings confirm that cormorant predation causes substantial economic impacts across Europe. Inland fisheries are affected through reduced catches and stock productivity, with estimated losses of EUR 150–220 million annually. Aquaculture, particularly pond-based systems, experiences production losses of 10–30 percent, with total damages likely exceeding EUR 250 million per year. Additional costs for prevention and mitigation further reduce economic viability, while compensation schemes remain insufficient. The findings highlight the need for coordinated European policy responses, including improved data collection, comparable assessment methods and implementation of the Framework for a European Management Plan for the great cormorant, balancing bird and fish conservation with inland fisheries and aquaculture sector sustainability.

ISBN 978-92-5-140920-6 ISSN 2221-6650

9 789251 409206

CE1056EN/1/08.26