Protecting threatened river **fish** against predation (**ProtectFish**)

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History of changes:

Date + section in DoA	**Nature of change and reason** *(please provide a brief text and include only main changes, there is no need to report on small editorial modifications)*
Part A	
26-1/NJ	Part A created based on "copy-paste" from the application
Part B	
1-2/NJ	Part B created and submitted – to be updated with changes after partners meeting
10/3	Part B modifyed with few changes of text to accommodate reviewer comments. Genetic kinship as a method for estimating population size (page 10) is ommitted, because of comments from referee and because we judge this method to be already available.
19/3	Financial tables updated with minor changes made neccessary because of a new diversion of tasks between UK and AU

1. EXCELLENCE #@REL-EVA-RE@#

Freshwater ecosystems are heavily stressed by anthropogenic, climatic and biological pressures. Eventhough they hold a large proportion of the world's biodiversity, the distribution and characteristics of many important species and habitats are poorly described. Overall, at least 37% of Europe's freshwater fishes are threatened at a continental scale, and 39% are threatened at the EU- level. A further 4% of freshwater fishes are considered Near-Threatened. This is one of the highest threat levels of any major taxonomic group assessed to date for Europe (DG Environment, 2011). Additionally, the Living Planet Index estimated that freshwater species populations have declined by an average of 83% between 1970 and 2018 and migratory fish species in Europe by an average of 93%. At the same time, it seems that freshwater ecosystems are less studied and less prioritized than terrestrial and marine systems (Birnie-Gauvin, et al. 2023).

Threats for river fish species are multiple and pervasive, spanning from damming, changed hydromorphology, chemical and organic pollution as well as over-exploitation. However, recent increases in predation pressure (e.g., from Great cormorant (*Phalacrocorax carbo sinensis*)) has further increased the pressure on many populations of river fish, even in healthy, restored or least-impacted areas. When the term "cormorant" is used in this application, we refer to the subspecies *P. carbo sinensis*, not *P. carbo carbo*, which has a stable population and mainly forages on open coasts, thus causing fewer conflicts than *P. carbo sinensis*. Stream dwelling fish are on the prey list for several avian, mammal, piscine and even reptile predators. In European salmonid rivers, the important fish predators include grey heron (*Ardea cinerea*), merganser/ goosander (*Mergus merganser/serator*), cormorant, otter (*Lutra lutra*) and introduced invasive mink (*Neovison vison*). It should be noted that conflicts based on a perception of high predation from cormorants have been intense in Central Europe for decades (Steffens, 2010), where especially brown trout (*Salmo trutta*) and grayling (*Thymallus thymallus*) are threatened or have even disappeared in several sub-alpine rivers (Mueller et al. 2018).

Many species of river-dwelling fish are in a very poor conservation status (Darwall & Freyhof, 2016), and even those protected by the Habitats Directive 92/43/EEC (Annex II and V) are not regularly monitored in many Member States (MS). Thus, documentation of the population trend and status is often lacking, hindering sound adaptive management, defined as: *A process that can improve management practices incrementally by implementing plans in ways that maximize opportunities to learn from experience* (Lorin et al. 2009). Furthermore, most river basins have populations of locally adapted and genetically distinct fish species, ESU (Evolutionarily significant Units). Therefore, every time one local population is lost, it is a significant loss of global biodiversity. The issue of predator control is highly relevant both in terrestrial and aquatic environments and the discussion relating to National Parks, Marine protected areas, rewilding projects, etc. is a battle ground in the public and political domain (exemplified by the increasing wolf-population-conflicts).

A decrease in populations of river fish species, specifically brown trout and grayling has been reported from most MS (EIFAAC, 2022). In several Danish lowland rivers, it has been documented that the density of grayling abruptly decreased by >90% after a change of cormorant foraging to also include rivers (Fig. 1.1, Iversen, 2010; Jepsen et al., 2014). These results are very similar to what has been reported from a number of central European rivers in the period from 1992 to 2000, where grayling and brown trout populations severely declined after cormorant visits (Steffens, 2010; Schmutz et al. 2023). It has been documented that cormorants cause, on average a 47% decrease in wild populations of EU-listed Atlantic salmon (*Salmo salar*) in Danish rivers (Jepsen et al. 2018) and substantial losses of lake-fish (Skov et al. 2014). In coastal habitats, cormorants were shown to exert critical predation pressure on eel (*Anguilla anguilla*) and flounder (*Platichthys flesus*) (Jepsen et al. 2010). Many studies have provided documentation of similar effects from cormorant predation, as well as tested management measures (Door et al., 2010; 2012), but most results from Europe are found in grey literature (e.g., Kainz, 1994; Görner, 2006, see also Ovegaard et al. 2021). Other studies have found a less pronounced effect of predation on wild fish populations (Anon, 2012) and this has led to a marked lack of consensus today on the impact of cormorants on wild fish populations making effective management very difficult (Behrens et al. 2008).

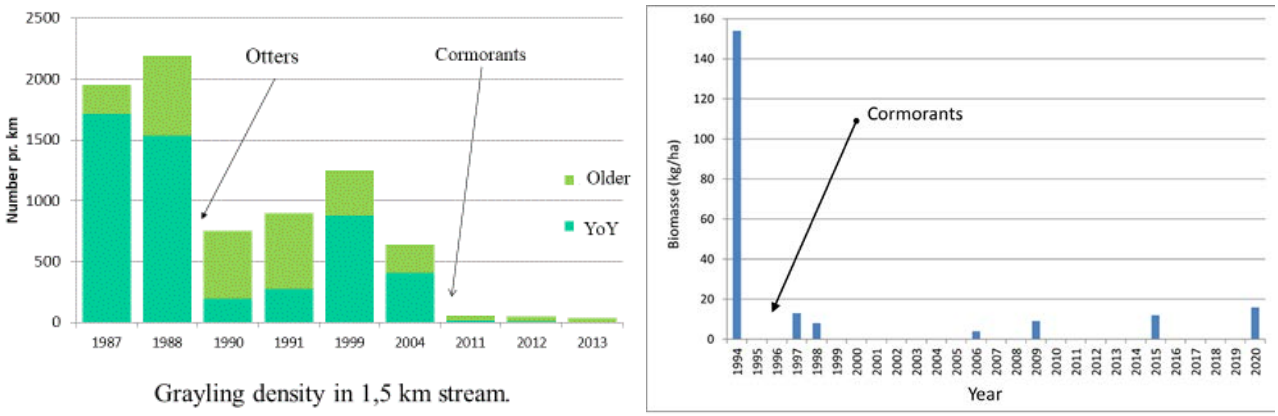


Fig 1.1. *Monitoring of grayling in a Danish lowland river (left) and an Austrian River (Enns, right) demonstrate the effect of cormorants. In Austria cormorants showed up in the 1990'ies (Schmutz, et al. 2023) in DK they started to forage in rivers during a cold winter 2009/2010 (Jepsen et al. 2018).*

Grayling and cormorants

Predation can be the main mortality factor for grayling (and other species), as has been shown in the few studies where predation was included (Jepsen et al. 2014; Pinter et al. in prep.), but overexploitation by anglers and deteriorating habitat quality (i.e. water quality, hydromorphology, the construction of dams, low water levels due to climate change) might be alternative explanations for the general declines of river fish. This seems not likely, at least for the Danish rivers because there is only a low recreational fishing pressure and grayling has been protected (no take) in Denmark since 2011. Consequently, fishing mortality cannot be part of the explanation of the collapse of the monitored Danish grayling populations. In addition, the surveyed rivers are in good ecological conditions with good water quality, high habitat heterogeneity and physical variation. Moreover, the physical and ecological habitat conditions in most Danish salmonid rivers have been greatly improved through 25 years of rather extensive and expensive river restoration, including the removal of many barriers. Provided that this is the case for most rivers in Europe, increased predation is the most likely reason for the recent reduction of local brown trout and grayling in EU-rivers. Several local studies make the same case, indicating predation, mainly from cormorants, to be the main reason for the loss of grayling populations (*Thymallus thymallus*) mentioned in the Habitats Directive annex V (Görner, 2006; Schwevers & Adam 1998, 2003; Steffens, 2011; Jepsen, et al., 2019). Mirroring the often-voiced observation of decreasing fish stocks shortly after increases in cormorant density or activity, there is a genuine concern among managers and stakeholders on how to protect wild populations of river fish as grayling, Atlantic salmon (*Salmo salar*), Marble trout (*Salmo marmoratus*), Barbels (*Barbus barbus, B. plebejus, B. caninus*) and Danube salmon (*Hucho hucho*) from unsustainable predation pressure (EIFAAC, advisory note, 2022).

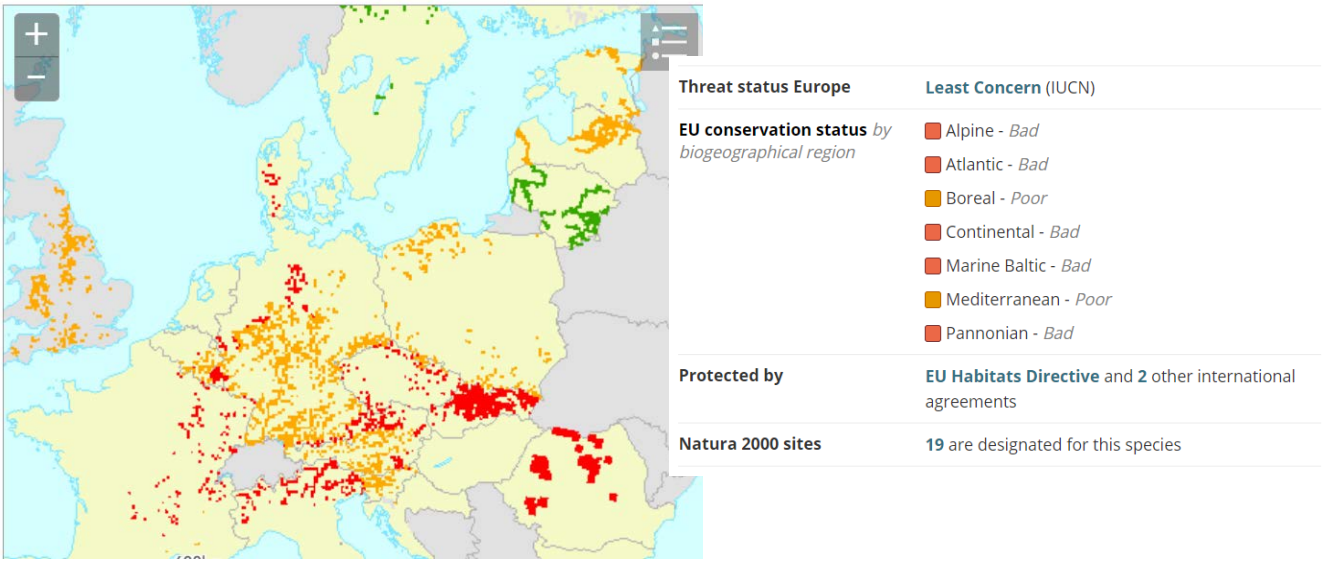


Fig 1.2. *Status of EU-grayling populations (2016-2018), EEA.*

Furthermore, there is also a concern amongst river managers, that predation makes it impossible to reach good ecological status due to the one-out-all-out principle in the Water Framework Directive (WFD), implying that all biological quality elements should be in at least good ecological status also including fish.
The conflicts involving fish protection and cormorants have been intense in most member states for decades and remain that way despite many protective measures, including culling (according to Birds Directive article 9-derogations). There are only very few well-documented examples of successful attempts to reduce avian predation (Draulans, 1987, but see Russel et al. 2012, 2021). Since the EU-funded REDCAFE and INTERCAFE COST-Action projects were finished (2008), the conflicts have further escalated and new documentation of damage to wild fish populations have been published, thereby changing the nature of the conflicts at least partly from commercial fisheries to species conservation i.e. balancing the need of how best to meet conservation requirements for species regarded as being in conflict. The existing tools to mitigate conflicts (i.e. Russell, et al. 2012), have apparently not been efficient or not used enough to reduce the level of the conflicts. Thus, there is a continuing pressure on managers and politicians to "take action" on the "cormorant problems" on local, regional, national and EU levels. The EU Parliament has raised the issue of a common EU management plan for cormorants several times and requested action from the Commission on this issue. The Commission however, states that management of cormorants falls within the competence of individual MS, who have the tools they need to handle conflicts by § 9 derogations. A recent survey with response from 17 EU MS, revealed a perception of a continued high level of conflict and high importance of predation on the fish stocks (Fig 1.3).

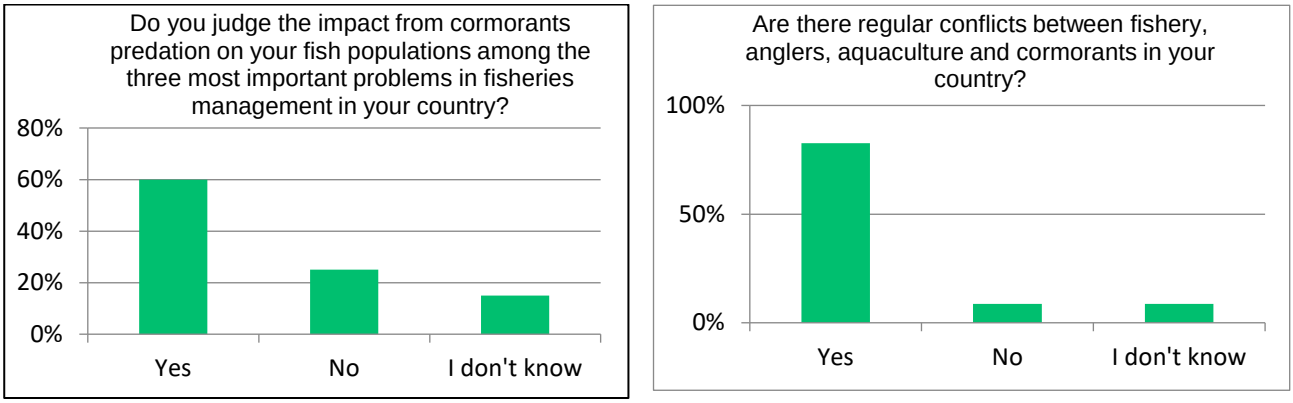


Fig 1.3. Results of a 2022 EIFAAC survey with responses from delegates from 23 countries

Acknowledging that the protection and restoration of EU-listed river fish species has not been successful despite an extensive effort spent on river restoration, ProtectFish will bring forward existing information and produce new scientific results to aid the protection of river fish. We will compile existing information regarding

species/population status, monitoring programs, evaluate the scientific basis of various public myths and claims from stakeholders and produce new documentation regarding the efficiency of protective measures. Thus, we aim at presenting updated, science-based information to managers at all levels to support decisions-making regarding management of grayling and other protected river-fish species in the EU. The fact that the issue of predation on river-fish has been scarcely studied and published, makes a science-based management difficult and conflicts may accelerate. For a meta-analyses of the impact of cormorant predation on fish, over 603 papers were identified, but only 22 quantified the effect and of these, only half were from EU (Ovegaard, et al. 2021). We see that a wider scientific and public consensus regarding the role of predation on grayling populations is needed to reduce societal conflicts as well as to facilitate effective adaptive management. In ProtectFish, we will use the predator-prey pair; grayling and cormorants as the focal case, but the scope for applying the results is wider as they relate to the many current and emerging human-wildlife conflicts (Klenke et al. 2012). If the opinion towards predator regulation/management change and conservation is improved, an important step is made for an adaptive management approach. A situation where protection of abundant predators is upheld regardless of the consequences for the prey species, will lead to conflicts in a largly human controlled environment. We feel that the success in protecting river fish in the EU is most likely depending on a consensus regarding the cause of decreasing fish populations. We presume that more research and dissemination of scientific results will lead to a higher degree of consensus, which in turn will lead to a more focused management. In addition, the obtained results will also feed into an assessment of the conservation status of the Habitats Directive listed river-fish, for which there is a high degree of uncertainty, due to limited national monitoring and reporting.

The positive effects from the implementation of the Birds- and Habitats Directives are undeniable and considerable for a number of species. Unfortunately, from a fish perspective, the development has been asymmetric to the benefit of animals predating on fish to the detriment of a number of fish species and populations. Thus, predation is likely becoming a significant factor in EU-MS's ability to reach the good ecological status in rivers, because many river-fish populations are considerably reduced compared to reference conditions. If that is the case, the usual management measures to increase the status of fish would be ineffective. Therefore, we will evaluate the importance of predation in relation to abiotic environmental factors and identify potential habitat features that may protect river fish from predation.

Scope of the Call area A (from the Work Programme)	**Addressed by ProtectFish through**
Contribution to "plan, manage and expand terrestrial and marine protected areas and improve the conservation status of species and habitats, based on up-to-date knowledge and solutions"	ProtectFish is going to point out solutions to improve the status of fish species under pressure and protected by the Habitat Directive. Such solutions will improve the conservation status of the respective species and affect the fish community. In doing so, the resilience of the whole ecosystem will profit, as fish are a key taxonomic group within the aquatic environment.
The favourable conservation status for species and habitats covered by the EU Birds and/or Habitats Directives	We will test whether general protection from predation can significantly improve the survival of river fish, thereby helping to attain favourable conservation status.
Clarification of what is needed on an EU or biogeographical scale or other ecologically relevant scales (e.g., major basin, major flyway) in line with the relevant parameters and their values on the basis of which Member States define favourable conservation status.	We will suggest an example based on cormorants and grayling, to define favourable conservation status for birds and for EU-listed fish to be biologically sensible, understandable for stakeholders and operational for management.
Improve the definition of "favourable conservation status" of groups of habitats and/or species protected under the EU Birds and/or Habitats Directives	Like the above, we will suggest how to define FCS for grayling and other river fish with Evolutionary Significant Units.
Provide guidance on how to improve the monitoring of habitats and species and/or the setting of favourable reference values and favourable reference conditions in Member States	We will investigate current monitoring of EU-listed river-fish species and provide recommendations for the type of information monitoring must generate to enable setting of reference conditions/status.
The focus of this work should be on data-deficient habitats and species, on habitats and species in the worst status	The focus is mainly on grayling, a highly data deficient species with declining trends on conservation status, and

(conservation status and/or EU Red list status), or with declining trends and/or on those species the recovery of which has created tensions with stakeholders (e.g., large carnivores, some geese species, cormorants, etc.).	on cormorant (also data deficient, WP2) whose recovery has created tension between groups of stakeholders. However, results will be relevant for the conservation of other fish species and for similar conflicts with abundant protected species, impacting declining species.
Ensure the recovery of habitats and/or species in unfavourable status and/or with a declining trend according to the reporting under the EU Birds and/or Habitats Directive by providing methodologies and recommendations on how to identify recovery needs for populations or restoration needs for habitats.	In field trials (WP4), we directly test the effect of management measures on the status of EU listed fish in an unfavourable conservation status (grayling). We also test the effect of habitat quality and heterogeneity on the population status of grayling, both by comparing populations over a range of habitat types (WP3) and by experiments under controlled conditions (WP4).
Direct drivers of biodiversity decline will be understood and addressed.	We will evaluate the importance of habitat quality, habitat heterogeneity and predation as direct and indirect drivers of biodiversity decline and test counteracting measures.
Protected areas and their networks will be planned, managed and expanded.	Areas, where fish may be protected against unsustainable predation will be expanded and better managed as a result of this project.
Practices in agriculture, forestry, fisheries and aquaculture will be developed and improved to support and make sustainable the use of biodiversity.	The current practice in aquaculture and recreational fisheries is very impacted by predation and the outcome from ProtectFish should help finding solutions to relieve that pressure for the benefit of both sectors.

1.1 OBJECTIVES AND AMBITION #@PRJ-OBJ-PO@#

ProtectFish will seek to answer the questions listed in Area A of the call: *Improving the conservation status of habitats and species protected under the Habitats and/or Birds Directive.* We will provide the necessary knowledge to protect EU-Habitat-Directive-listed fish species and to improve the conservation of river biodiversity, by evaluating the significance of predation pressure for river fish populations and by developing protection measures. Thus contributing to the Biodiversity Strategy 2030 and to the improvement of the ecological status of rivers according to the WFD 2000/60/CE. Decades of documentation have indicated that predation from abundant piscivores is an important cause for the very critical situation for many river fish species in the EU. However, the success has been marginal, despite countless measures taken by MS to locally reduce pressures and improve fish populations. The issue of predation management/control is highly relevant both in terrestrial and aquatic environments, also regarding predator regulation in National Parks, Marine protected areas, rewilding projects, etc. which are intensively discussed in the public and political domain. Now it is more important than ever to develop and promote educational material that inform about stakeholder-balanced, science-based, adaptive management of natural resources and biodiversity. Co-creating such a management in cooperation between science, NGO's and river managers will at the same time improve biodiversity, utilize ecosystem-services and ensure the quality of life while reducing conflicts.

The overall objective is **to improve conservation status of threatened European river fish species**. To achieve this, the following **specific objectives (SO)** will be addressed in the project:

SO1: Update and expand the scientific knowledge of cormorant populations in the EU and assess efective, balanced and feasible methods for their management.

Outcomes	KPIs and value
Updated information on current state of the cormorant population and the use of lethal management. A specific (monitoring and analyses) method to assess conservation status.	Scientific publications (2) Popular scientific papers (>2) Datasets published in an open data repository (>2)

Documented effects (i.e., abundance of listed species, fish species richness, biomass and structure) of reducing cormorant predation in rivers	Scientific publication/ conference contribution (>3) Datasets published in an open data repository (>3)

SO2: Evaluate current conservation status, monitoring and protective measures of EU-listed river-fish species.

Outcomes	KPIs and value
Updated information on current state of EU-listed river-fish populations and their monitoring in addition to providing a specific method to assess conservation status	Scientific publication (1) Datasets published in an open data repository (>2)
A quantification of the impact of reduced predation on river fish communities in terms of species composition, population density, biomass and size structure	Scientific publication (> 2) Datasets published in an open data repository (>3)

SO3: Use current and new data on fish and cormorant population status as well as their interaction to generate knowledge-based recommendations for a balanced, integrative and adaptive management of river biodiversity

Outcomes	KPIs and value
A science-based model indicating potential hot-spots of predation effects on river-fish in different habitats	Model published (1)
Recommendations for an efficient river management for balanced cormorant – fish populations, and how to protect the fish	New management recommendations adopted by river managers (>7)
Information/tools to facilitate science-based EU-wide and local management decisions on reducing unsustainable predation and reach favourable status for EU-listed river fish species	Local authorities are aware of the new model/ management recommendations (>5). Relevant EU authorities are aware of the new model/ management recommendations (>1)
A knowledge-base to reduce conflicts between protection of cormorants and fishes	New management recommendation adopted by relevant businesses (fisheries, fishing businesses) (>7)
The general public has been informed about the generated knowledge and the recommendations for how to protect and manage river fish species and cormorants, leading to a more informed debate	Publications in sci-popular journals in local languages SoMe-outputs, Informational videos (>10)

1.2 METHODOLOGY #@CON-MET-CM@# #@COM-PLE-CP@#

ProtectFish will strive to provide field-based, solid and easily understandable results that point forward to a future adaptive management of EU-listed river fish populations. This means that most project resources and efforts will be allocated to data collection and field studies, with an empiric/pragmatic focus. We will observe and measure if, and to what extent and under which environmental conditions fish population improve after decreasing predation pressure. The topic of predator-prey interactions in a natural setting is inherently very complicated and very dynamic. In nature, many ever-changing factors play relevant roles and at the same time both predators and prey change their behaviour (and even physiology), forming the basis for evolution. Instead

of trying to understand all these factors influencing the role of predation, we attempt to observe the development in the fish population after decreasing the predation pressure. With several large- and medium scale experimental sites, and two-three seasons to monitor from, we will be able to document the occurrence or the absence of a general effect of reduced predation and potentially identify environmental factors preventing fish recovery in spite of the reduced predation.

Our ambition is to contribute to the **improvement of the monitoring and protection of river fish in the EU** (area A of the Call) through:

- evaluation of, and suggested improvements of current monitoring practises,
- recommendations for how to enhance the implementation of the Habitats Directive, regarding river fish,
- and suggesting a definition and use of the term Favourable Conservation Status for **our case species, cormorants and grayling** as well as other EU-listed river fish**.**

ProtectFish will use a combination of various types of field experiments, review of existing results and consulting/workshops/interviews to compile and analyse new data and evaluate and condense existing knowledge regarding predation effects on protected river fish in the EU. Details of the methods are found in Table 3.1B. To be able to quantify cormorant predation pressure on specific fish populations, cormorant foraging distance from night roosts will be studied by satellite tagging of wild cormorants (WP4). This distance has not been studied before and the results are crucial to determine if cormorant predation is a relevant factor in a given river (stretch). An EU-cormorant survey will be performed with the help of volunteers and by citizen science, combining local/regional and national data. An estimate of the amount of lethal management in EU will be provided (WP2). The impact of predation on grayling populations is analysed first and foremost in two sets of field experiments. To assure that the results point forward in time, we do not try to identify the main reason for the decline of grayling populations but allocate many resources to conduct "exclusion experiments" where predators are kept away from an area (treatment) and the fish population dynamics in these sites are compared to similar areas without any measures (control). Thereby we are able to assess the potential effects of a reduced predation pressure. We will perform BACI-type experiments in two spatial scales (small: 100-300 m stretches; large: >30 km stretches). In a number of relatively short river stretches, we will effectively exclude (avian) predators from October to March by covering the sites with net or strings (WP3). The fish population will be surveyed before exclusion and then in March. The change in density, numbers and biomass will be measured to compare with similar values from comparable control stretches, where predators are not excluded. With this design, we can estimate the effect of avian predation in rivers on the relative survival of fish. The short time-, and small spatial scale makes the method most suited to study the winter survival of YoY (young of the year) in spawning and rearing areas (where the juveniles are quite stationary). The relative high number of replications will allow us to analyse environmental factors modulating the effect of the reduced predation, although the low spatial scale might reduce the transferability of the results. To mitigate this short-coming, two large-scale field studies will be carried out in Austria and Poland in two relatively large rivers (Drava and San) for 3 years (WP4). In the first phase of the experiments fish will be sampled in two long stretches of each river, the size distribution and density of each species will be estimated, and the total fish biomass will be calculated in the early fall. From the first winter onward, scaring/hunting parties will be organized to achieve daily disturbance of predators. The effort to regulate cormorant presence will be recorded throughout the experiments. At each river one stretch will be patrolled and one will serve as control. PIT-and radio- tagging and of fish will provide information on the predation pressure by recovering tags from cormorant roost sites. After each winter (second study period), all four stretches will be surveyed, fish population and biomass measured and the comparison of fish population between patrolled and control sites will provide documentation for the potential effect of a decreased predation pressure.

Both types of field experiments will also be used to help validate a method to estimate predation pressure from ornithological data and landscape characteristics, which will be deduced from analyses of existing data (WFD-monitoring). Therefore, several experimental stretches will be equipped with game cameras to estimate predator visits/abundance, to be used as relative measure (observations per day and camera). Further analyses of existing data and from additional field surveys will be used to identify relevant landscape factors affecting predation pressure at larger spatial scales as well as potential effects of predation on WFD assessments (WP3). The main results regarding cormorant feeding behaviour and distribution as well as data on predation effects

and modulating landscape factors will be fed into a generic model to translate the gathered information to EU-scale. Thereby we will provide a spatial estimation of areas where grayling is probably heavily or only slightly affected by predation pressure, which might guide protection efforts.

The evaluation of the ecological status of rivers is based on the assumption that environmental factors (hydromorphology, nutrient concentrations, toxic stressors) shape community composition of the biological quality elements (BQE) including fish, benthic invertebrates and periphyton/macrophytes (Karr 1981, Bohmer et al. 2004). However, ecological research provides many examples where biotic interaction such as predation, competition or grazing shape community composition (Jackson et al. 2001, Hillebrand 2009). We can therefore assume that the BQE in rivers might be affected not only by environmental pressures but also by biotic interactions. As bird predation can affect fish stock in rivers (Ovegard et al. 2021) and fish predation can affect benthic invertebrate composition and even periphyton (Winkelmann et al. 2014, Worischka et al. 2014), a strong predator-prey relationship between piscivorous birds and certain fish species has the potential to change community composition of the biological quality elements of WFD. This might affect WFD assessments, directly for fish and potentially indirectly for benthic invertebrates. If that is the case, the basic assumption of WFD assessments of a nearly exclusive control of community composition by environmental factors, should be reconsidered. The question would arise, how the goals of WFD compare to Habitat Directive' aims and whether a certain trade-of is required to reduce goal conflicts in environmental protection policy.

1.2.1 *Open Science & IPR*

In the interest of full scientific reproducibility of method, and optimal access to all research outputs and results, ProtectFISH defines and treats all outputs as data (field & experimentation datasets, model output, analysis, data synthesis, code & assessments, policy briefs). The project Data Management Plans (DMP; Deliverable D1.3, D1.4 and D1.5) aspires to 100% FAIR & Open Access to all digital output, where practical. Full access, interoperability of outputs, and conditions for their re-use will directly empower the Exploitation Plan (cf. Section 2.2 and Table 3.1 WP5). In addition, one major focus is the re-use of existing observations, data synthesis and model output data sets - provenance and credit will be provided according to the respective data usage license. Creative Commons Licenses (CC) will ensure clarity on all outputs re-use conditions, with priority on minimal restrictions, and Digital Object Identifiers (DOI) will allow versioning, citing and analysis of re-use of all outputs. Personal data and sensitive information are not part of the research content, but contact details of stakeholders and advisory board members will be processed and stored in line with GDPR requirements. Curation and storage/preservation costs for data management quality assurance including FAIR Principles implementation, are distributed between WP1, Task 1.4 and WP5 Task 5.3 Dissemination partners. ProtectFish results have no direct commercial exploitation, however in the interest of "best Intellectual Property Rights (IPR) practice" Task1.4 directs all partner to the Consortium Agreement, for full consultation with institutional Tech Transfer offices where & when implementation may require it.

1.2.3 *Data management*

DTU/AEU will set up a digital data curation and storage system, accessible by all participants and for the storage of all data and reports from the project. The data will be made compatible with OpenAIRE+ to ensure that it is easily accessible throughout Europe. Following conclusion of the project all data outputs listed in Section B, will be available to the public through this server. In compliance with EPSRC data requirements, data will be stored there for a minimum of 10 years from the conclusion of the project. DTU has a research repository for storing open-source publications resulting from the project, and other participants will store their open-source publications in their own open-access repositories (multiple authorship will ensure that all open-source are accessible within at least one repository) and encouraged to upload open-access journals to other repositories such as Research Gate (currently 8 million users).

1.2.4 *Gender Dimension*

While gender dimension of the study species is of no consequence to the research objectives, ***ProtectFish*** aspires to contribute to SDG5 (gender equality) targets by embedding gender dimension in the consensus-building part of implementation and Exploitation of Results. Recent research provide indications that gender equality facilitates conservation action (Andrijevic 2020). Our approach toward policy domain end-users will be guided by recent research showing that women and men with decision power often have different perceptions about Ecosystem Services, and women in position of policy power also are conversationally more receptive (Yang 2018; Yeomans et al., 2020).

2. IMPACT #@IMP-ACT-IA@#

2.1 PROJECT'S PATHWAYS TOWARDS IMPACT

ProtectFish provides guidance on how to rebuild stocks of river-fish species listed in the EU Habitat Directive. Knowledge will be elaborated that can be directly implemented in legislation and management. This will be achieved through (1) a foundation consisting of a comprehensive overview of the distribution and population size of cormorants in Europe, the identification of management options and the effects of regulation, and (2) an overview of the need and success of actions to bring fish species of the Habitats Directive back to a favourable conservation status. Thus, ProtectFish is perfectly aligned with Horizon CL 6 strategies to strengthen and balance environmental goals, and to better manage natural resources. The elaborated decision support for assessing the necessity and implementation of cormorant management will guide managers and authorities to set actions for a balanced and satisfactory coexistence of cormorants and fish stocks. Outputs will have a direct impact on further development and concretization of legislation and management of threatened fish species of the Habitats Directive. Roadmaps will be made available to the conservation community as they become known and will feed into the ongoing discussion on the fish-cormorant conflict. Already during the project course, a co-creation process including relevant stakeholders will be facilitated to ensure co-ownership of results as well as the positive development of fish and cormorant stocks far beyond the project period. For the further implementation of the most powerful tool of the European Union to protect and enhance aquatic ecosystems – the Water Framework Directive – and the achievement of its required goals, ProtectFish will be a turning point by providing specific impact assessments of avian predation. When the hitherto largely undocumented effect of cormorant predation on the status of listed river fish in European rivers is quantified, it will be possible to re-evaluate the measures taken so far for the renaturation and restoration of rivers and their fauna.

ProtectFish first and foremost addresses **decision-makers at EU level, national level, and nature conservation entities**. They will receive guidance on how to rebuild stocks of threatened fish species listed in the EU Habitat Directive by providing knowledge that can be directly implemented into best practice and legislation. Beyond that, ProtectFish is beneficial for all legal entities and communities as well as public interested in the cormorant-fish conflict:

- **NGOs** from the fields of ornithology as well as aquatic ecology or ichthyology will be provided with knowledge about the extent to which cormorants influence the conservation status of certain endangered fish species. ProtectFish will therefore shed new light over the question that has been around for decades and has led to heated debates within the conservation scene. ProtectFish will not only seek to clarify these long-standing issues, it will also provide the opportunity to take targeted action and it will create space to refocus on problems such as habitat degradation or climate change.
- Similarly, the **fisheries sector and river managers**, as direct beneficiaries of fish as a resource, are informed and provided with decision support on how to manage endangered fish species. The recreational fishing sector of more than 50 million recreational fishers in the EU, will benefit by means of the increasing recreational value. Their activities worth an excess of 30 billion euros depend largely on the maintenance of healthy, harvestable fish stocks in the rivers. Recovered fish stocks will thus not only have positive effect on biodiversity and ecosystem integrity. It will create jobs, and boost European competitiveness and growth, particularly in rural economies. In reverse, aquatic ecosystems will come to the fore of people's attention and become more appreciated: an essential prerequisite for the protection and conservation of water bodies.
- ProtectFish will be a considerable enrichment for the **scientific community**. The issue of conflict species is currently present at many levels in the aquatic realm alone (goosander, otter, etc.). ProtectFish will focus on this issue in relation to the cormorant and pioneer the resolution of these conflicts. The results will likely be transferable to other conflict-species and may advance science by a large step. Most of the partners of ProtectFish are research driven institutions, and achieving high scientific impact is very much at the heart of this project. Outputs of ProtectFish need to be scientifically sound and accepted by peers if they are going to achieve societal impact. Thus, ProtectFish aims to produce a series of high impact peer-reviewed publications, management-papers/reports, educational material, conference contributions and social media news in relation to protection of river fish, monitoring, definition of status and adaptive predator management. The various new methods used in ProtectFish and the understudied nature of the effects of predation, will

cause much scientific interest and be of great inspiration for similar studies to be carried out to support adaptive management globally.

- Six tertiery Education Institutions and three NGO's (in the advisory board) are represented in ProtectFish and the project has strong education and outreach components for **public involvement and education**. The project will merge public knowledge with expert assessment from participating NGOs, thus highlighting the value of participatory resource management. The issue of predator management is highly relevant both in terrestrial and aquatic environments and the whole discussion regarding National Parks, Marine protected areas, rewilding, etc. is a battle ground in the public and political domain. ProtectFish will thus meet this more than ever important need to develop and promote educational material that inform about balanced, science based, adaptive ecosystem and resource management.

Beyond these direct impacts on various groups of the society, the transnational cooperation of ProtectFish will serve to showcase what Europe can achieve in terms of **international strategic collaboration**. Knowledge transfer promoted through the consortium will help to overcome the innovation divide between regions and demonstrate the benefit of cross-border adaptive nature management, just like the AEWA European Goose Management Platform for Pink Footed Geese had done before. The knowledge gained and implemented through ProtectFish benefits biodiversity and supports to achieve the goals of the EU biodiversity strategy 2030. If unsustainable predation of river-fish has to be managed in an adaptive manner, it will be of great benefit for both river- and lake-ecosystems and will reduce societal conflicts. On this path, the outcomes will also make an important contribution to the nature restoration law proposed by the EU by answering questions related to how to protect and enhance biodiversity and how to innovatively manage wildlife in a world superimposed by humans. The immediate societal benefit will be in clarification of whether predation is preventing recovery of fish stocks or if other (anthropogenic) impacts are to blame. Other benefits are located in the possibility to evaluate and revisit existing legislation to restore aquatic ecosystems: a prerequisite on the roadmap to creating intact ecosystems holding a rich and vital fauna. Yet, predator management is still insufficiently taken into account in the restoration of the European Union's waters, but it must be perceived as a potentially essential component. Thus, the value of ProtectFish also lies in shedding light on the extent to which predators prevent or reduce restoration success, which is an aspect of aquatic ecosystem management and restoration that has been largely unaddressed to date.

Risk level and expected returns: ProtectFish offers a high expected return in relation to the level of risk, as well as good value for money. The research envisaged, will meet not only the needs presented in the Call, but also deliver highly required scientific evidence to base urgently needed river (predator) management decisions on. Our results will be supporting management at various levels, to enable a focused and efficient protection of river fish. The tangible results will be addressed through clearly defined deliverables grouped around five work-packages, commensurate with the duration of the project and the number and expertise of the partners. The level of risk is relatively low, due to the diverse portfolio of tasks and replicate experiments in both time and space.

Obstacles for achieving Impact:

Political – the very nature of predator-prey related conflicts, makes the issue rather politically sensitive and there is a risk that the results and recommendations produced in ProtectFish will be opposed or ignored by different management levels, due to political reasons. The early and extensive dissemination of the results should promote a discourse from the very beginning, which ideally leads to a co-creative process of all interested stakeholders that will be beneficial for the project.

Ethical: There could be some ethical obstacles because we work with protected species and carry out locally lethal predator control. Some stakeholders oppose any type of lethal control, so if local conflicts occur, we may have to adjust study design slightly to accommodate critics. However, all national permissions for conducting research on living organisms will be obtained before the projects starts and all rules for welfare of living organisms will be kept.

Economic: ProtectFish is not likely to run into economic problems, given that most of the budget is allocated to salaries, travel and meetings. We do need some rather expensive equipment, but the cost is spread out so that even some malfunction or increased price should not compromise the results, also the most expensive gear, like boats, electrofishing equipment and cars are in-kind contributions.

2.2 MEASURES TO MAXIMISE IMPACT: DISSEMINATION, EXPLOITATION AND COMMUNICATION #§COM-DIS-VIS-CDV§#

Communication, dissemination, and exploitation (CDE) activities are critical for reaching the wider impact and knowledge transfer of ProtectFish findings. Accordingly, a specific work package is dedicated to these activities (WP5). CDE-activities will be undertaken in a coordinated way, based on a detailed dissemination & communication plan which will be constantly checked against the current situation and, if needed, adapted and complemented. In order to exploit synergies and avoid overlaps during dissemination & communication, a Steering Committee will coordinate these activities. Actions will be reported with subsequent plans: Initial Communication and Dissemination Plan (D5.1 due M6), Mid-term Exploitation and Communication & Dissemination plans. Report on communication & dissemination (D5.3 due M21) and Final Dissemination and Exploitation plans (D5.4. due M45).

ProtectFish will implement a range of activities to ensure the optimal visibility of the project and its results, increasing the likelihood of the tools developed in the project (models, guidelines, recommendations as described in Table Outcomes, KPIs and value under Section 1.1) being seized by the relevant audience (policymakers, river managers and others). Table 2.2a summarizes the focus of activities and how the CDE activities fit together.

Table 2.2a. *Communication, Dissemination and Exploitation synergy.*

Communication activities	Purpose – Raise awareness of project aims and outputs amongst broad stakeholder base. • Communication KPIs to measure effectiveness and efficiency of the tools developed • Messaging and visual identity of the project • Stakeholder mapping and community of interest-building • Communication channels (website, social media, newsletter, printed materials, videos, press releases, final ProtectFish conference). • Liaising with other relevant EU funded projects and groups of interest
Dissemination plan	Purpose – Support dissemination and political outreach. • Dissemination strategy: objectives, targets, activities, messages and channels. • Dissemination KPIs to measure the dissemination effectiveness and efficiency. • Management of the three dissemination activities: – packaging knowledge for an effective take up, – reaching the selected early adopters to motivate for changes, – preparing the effective exploitation of the project results. • Organisation of and participation to workshops/conferences targeting relevant public and stakeholders. • Scientific publications • Development of policy recommendations and organisation of bilateral meetings in Brussels with EU policymakers and relevant stakeholders
Exploitation	Engage in local, national and EU-level development of management plans including pretection of fish. The outputs of ProtectFish will be a suite of active assets in coming actions to restore EU listed river fish and aquatic biodiversity. The deliverables as well as the networking from ProtectFish will be picked up by stakeholders, news media and policy-makers and facilitate a qualified debate on the future of EU river fish.

CDE strategy focus is to build a sustainable user community that will adopt and exploit ProtectFish results and recommendations. ProtectFish CDE actions will focus on building a stakeholder community that can be sustained and increased during and after the project lifetime. This strategy will contribute to demonstrate the high relevance and quality of the project's findings and solutions proposed.

Table 2.2b summarises main targeted audience and stakeholders´ groups initially identified in ProtectFish CDE preliminary strategy.

Table 2.2b. *ProtectFish targeted audiences for Communication, Dissemination and Exploitation activities.*

According to the stakeholder analysis performed by the consortium in the preparation phase of the proposal, following target groups were identified which will be consequently targeted by specific dissemination & communication activities. For each target-group, the obstacles for achieving impact due to political or ethical reasons (see Section 2.1) have been identified and further attention on CDE activities and key-messages towards these communities will be paid. CDE activities will aim at showing that the project abides with all

animal welfare rules and will reach out to all stakeholders, including those opposed to lethal control, in an educational way and cooperative approach.

Target Group	Description/Engagement
European associations and networks, and beyond	To build a stakeholder community aimed at promoting ProtectFish project and solutions and influencing the decision-making at the European level, there is a strong need to connect and engage with European associations such as: the European Anglers' Alliance, Bird Life, the Living Rivers Europe network.
Environmental Social and Tourism	The dissemination and exploitation strategy will consider **Environmental Bodies, Local Tourism Entities, Organizations/Associations on Social/Economic life on the area,** etc. as key stakeholders to evaluate social acceptance/resistance to the protection of fish population and solutions brought forward by ProtectFish.
Regional and Local Networks	The Communication and dissemination, as well as Exploitation plan to be implemented in ProtectFish will **engage with the main local/regional stakeholders** in these, and other potential areas, **to maximise project results and applications of ProtectFish's solutions.** The knowledge transfer promoted will help overcoming innovation divide between regions and demonstrate the benefit of cross-border adaptive nature management. Ex: River Basin management authorities, regional and local authorities in charge of river management, protected areas managers, local stakeholders...
Policy Makers, & Regulation Bodies	ProtectFish will actively reach out **to Policymakers at European, National and Regional level (Governments, Ministries, Agencies, Councils and others), Regulation bodies**. **Policy makers** at European, National and Regional level to provide policy recommendations. In order to implement effective policy recommendations from the project, the following activities will be undertaken: (1) Targeted messages towards policy makers – local, regional, national and EU level: Targeted messages to seek support at Member State levels to increase fish population preservation, and (2) Bilateral meetings with EU / National policy makers and relevant stakeholders, to report on predation risks, environmental impacts, hazards and new practices related to fish preservation. Political agendas and legislative developments at the EU and local/ national levels should be assessed for further opportunities for recommendations and policymakers engagement. ProtectFish representatives will attend the main EU events affecting Fish Protection, Biodiversity and environment policies and in particular **EU institutions-organised events related to biodiversity protection and nature restoration.**
Media	As opinion makers targeting a large audience through different channels. Press releases, invitation to events, or inform about the progress of the project. Positive information on the potential of ProtectFish's proposed solutions will help raising awareness among the citizens. Both specialised and general media will be targeted.
General Audiences	ProtectFish will communicate and disseminate in a tailored, accessible in the form of story-telling format, the main objectives and results of the project to the broad, diverse general public and journalists. Scientific-based evidence resulting from the project will be translated into short report/presentations to highlight the complexity of fish preservation and population management (developing infographics). A set of mass one-way communication & dissemination tools and mechanism have been planned and covered in detail in table 2.2c. Use of appropriate language, channels and tools to (1) 'Push' communication (graphic identity, newsletters, press releases, promotional materials, website gadgets, etc.) and (2) 'Pull' communication and interaction (social media, liaison with other initiatives and projects including community groups, face to face events, joint communication, etc.).

Table 2.2c. *Principal Communication/Dissemination Measures and Performance Indicators preliminary foreseen in ProtectFish project.*

How	Why	To whom	What	When	KPI / Target
Website	Awareness, Inform, Engage, Promote	All External Stakeholders	General project info, objectives, impacts, consortium, progress, events, feedback form, etc.	Launched by M6. Ongoing throughout project & four year after project	> 5,000 visits > ,500 users
Brochures	Awareness Inform.		Project aims, expected impacts, consortium	Available from M6, throughout the project website.	>750 digital copies distributed
Newsletters	Inform, Promote & identification of synergies with other researchers.	Nationalparks; Nature management authorities; Academics Education; Policy-makers	Project progress and updates; Testimonials and interviews; Reports and results, Roadmap objectives, etc.	8 along the project, released every 6 months (starting M6).	>100 consultations received
Project videos.	Awareness, Inform, Engage Promote	External Stakeholders	General project info, results from the projects, benefits from the use of ProtectFish guidelines	Graphical video released at M12, final promo video released at M42.	2 videos with >750 views in project website & alike
Press Releases	Awareness Inform,	General public	Public interest content about the impacts of the project for biodiversity, fish protection, nature management planning	Ongoing throughout project, and in line with generalist media interest. Press releases in local language from all partners.	>10 extern medias publishing it (clipping).
Social media	Awareness, Inform, Engage	External Stakeholders	Posts about recent developments, updates, observations, conclusions	Social network profiles updated weekly.	> 200 Readership & consultations/ likes
Conference Presentations & Posters	Engage, Promote	Research community. Policy-makers,	Scientific and research methodology & non-confidential results.	Worldwide Conferences	>15 conferences presentations or posters.
Journal Articles	Inform	Research community	Peer reviewed. Research papers & technical journals showing results & conclusions	High impact journals with Open Access.	>7 Publications
Hybrid local Workshops	Inform, Engage, Promote	Local authorities, General audience, young scientists	Knowledge transfer, exchange of ideas and good practices, feedback collection from on-the-ground realities	Four workshops	> 30 attendees to each workshop
ProtectFish final conference	Engage Inform Promote	Open to all external stakeholders and public at large. Policymakers.	Presentation of project's outcomes and policy recommendations.	Final year of the project	>100 attendees
Demonstration	Demonstrate methods and	Relevant stakeholders	On-site demonstration of the effect of	Month 42	News articles,

	results	and interested	reducing predation		media-cover, > 100 participants

ProtectFish final conference (M45) will be organized in Austria or Poland close to the field studies to showcase the project outputs. Particular efforts will be paid to approach and liaise with general public as well as stakeholders and policy makers, who are recognized as playing a strategic role in amplifying the outreach of the project solutions and multiplying the impact of ProtectFish. The conference will also provide a focused forum for discussion on the results of the policy recommendations.

2.3 SUMMARY

SPECIFIC NEEDS	**EXPECTED RESULTS**	**D & E & C MEASURES**
What are the specific needs that triggered this project?	*What do you expect to generate by the end of the project?*	*What dissemination, exploitation and communication measures will you apply to the results?*
Several species of river fish are threatened and in a decreasing trend, new measures are needed. How generally improved river conditions can be translated into improved fish populations. Reaching consensus on the causes of decline of threatened fish species. Sustainable solution for the EU-wide conflict between cormorants and threatened river fish. Overview of the monitoring and protective measures for EU-listed river fish.	A consensus-building documentation of the importance of predator-prey interactions for river fish populations. An evaluation of concrete measures to protect EU-listed river fish, effort and benefit. A new inventory of the number of cormorants in EU as well as the number culled every year. An overview of the monitoring programmes used by MS for listed river fish species. An evaluation of the ability of naturalized, cryptic habitats to reduce predation. An improved definition of favourable conservation status for EU-listed fish species (graylings).	Presentations in European and international conferences and/or posters exhibitions. Organisation of international conferences to build a community of interest and commitment to deliver data. Policy recommendations based on the project's outcomes. Bilateral meetings with EU policy makers and relevant stakeholders to present policy-recommendations. Clustering with EU-funded projects (LIFE, Natura 2000 sites, HEU) and groups of interests (Advisory Councils). Multilateral meetings and roundtables at EU and local policy level (NGOs, public authorities, technicians). Local workshops to be held in strategic conflict hotspots to allow project results presentations and knowledge transfer, exchange of good practices. Reports and other project documents: public reports & studies, guidelines for a better fish protection plan will be disseminated towards our stakeholder community throughout various tools. Final Conference to raise awareness among policy-makers, European networks, media and public audience. Communication tools to support these activities: • Logo and project branding • Project videos • Website and social media channels • Promotion material for events: posters, leaflets, roll-ups

TARGET GROUPS	OUTCOMES	IMPACTS
Who will use or further up-take the results of the project? Who will benefit from the results of the project?	*What change do you expect to see after successful dissemination and exploitation of project results to the target group(s)?*	*What are the expected wider scientific, economic and societal effects of the project contributing to the expected impacts outlined in the respective destination in the work programme?*
River managers from local to EU level. Nature conservation groups and anglers. Policy makers at local and EU level Scientific community EU citizens Fishing businesses and tourism (e.g. SMEs offering recreational fishing, fisheries) European associations and networks	Improved conservation status for EU-listed, and other river fish species. Defined and validated parameters for protection of river fish (graylings) and habitats conservation on the EU level A science-based generated knowledge and data usable for further investigations of biodiversity protection Improved management of rivers and their fish from the local to EU-level. A united focused conservation effort in rivers, less driven by conflicts, but by a common ecosystem understanding.	**Scientific:** • New knowledge and datasets on biodiversity conservation and protection available as open publications and open data. • Show-case for dealing with nature conservation conflicts/conflict species. • Data on impact of predator-prey interactions for grayling generated and interpreted. **Societal:** • Increasing abundance of EU-listed fishes in European rivers by at least 50%. • Improved management of protected area for European river fish species. • An EU-wide consensus and implementation of biodiversity support policies for the effective management of cormorant populations and protection of listed European river fish species. • The EU-wide conflict among “green groups” may be mitigated and thus decrease the level of societal conflicts. • Cormorants-grayling conflict known and understood by a wide public, means of protection/regulation are accepted. **Economic:** • Clear rules for fishing businesses, enough fish for recreational fishing, enabling development of local fishing SMEs. • Recreational fishing and related tourism increase with increasing fish abundance.

3. QUALITY AND EFFICIENCY OF THE IMPLEMENTATION #@QUA-LIT-QL@# #@WRK-PLA-WP@#

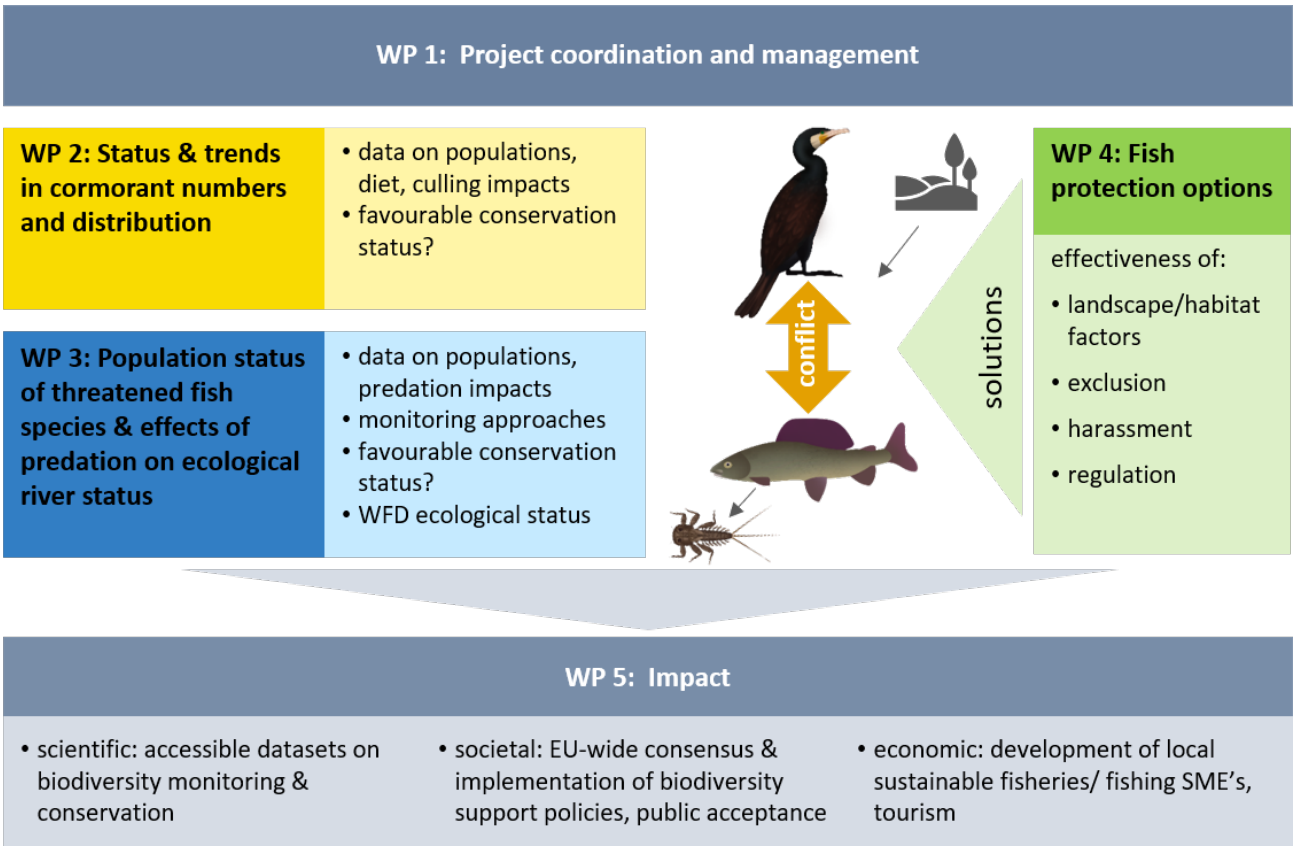
3.1 WORK PLAN AND RESOURCES

The work of ProtectFish is distributed into five work-packages (WP's). The most detailed information on the planned activities can be found in the individual WP-descriptions below. WP-1 deals with project lead, coordination, administration and internal communication. WP-5 is entirely allocated for impact and will take care of dissemination, outreach, interface, social media, and external communication.

WP2 will focus on the cormorant population in EU. WP2 will focus on the status of the most likely threat to grayling, the cormorant. This WP provide updated information on the size and distribution of the cormorant population in EU. It will describe trends in the development of breeding and wintering populations, and it will give an overview of the extent of culling in different parts of Europe. The concept of favourable conservation status will be discussed and recommendations for how to proceed with the use of this term will be provided.

WP3 will focus on the EU-listed river-fish species, their status, the monitoring programs and the protective measures taken. This part of the project includes much collection of existing data to be analysed and eventually feed into a clearer understanding of how predation impact river ecology in general and the EU-listed fish species in particular.

WP4 has the purpose of testing possible measures to reduce predation on the populations of river fish in the field. Here large-scale and small-scale experiments are planned to gain information on the effort needed to substantially reduce predation and what the gain may be in terms of improved populations of fish. Also, characteristics of natural habitats excluding predation by providing better hiding options for the fish will be studied in the field and experimentally with caged cormorants. Also the foraging distance from night roosts of cormorants, will be estimated by the use of GPS-tagged cormorants.



#§CON-SOR-CS§# #§PRJ-MGT-PM§#

ProtectFISH Gantt	20 25												20 25						20 26						20 26						20 27						20 27						20 28					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
WP1 Coordination and management																																															
Task 1.1 Setting up the project structure	M1.1			D1.1																																										
Task 1.2 Scientific and financial project coordination	M1.3						M1.3												M1.2				M1.3								M1.3						M1.2								M1.3		M1.2	
Task 1.3 Internal communication and procedures	M1.1/M1.2																																														
Task 1.4 Data Management					D1.3											D1.4														D1.5																		
WP2 Cormorants: Conflict potential and conservation status																																															
Task 2.1 Conference on status and trends in cormorant numbers																			M2.1						D2.1/M2.2																							
Task 2.2 Status and trends in breeding populations of cormorants																																												M2.4		D2.3	
Task 2.3 Extent and risks of culling of cormorants in Europe																			M2.3																						D2.3						
Task 2.4 Criteria for determining conservation status of cormorant populations																									D2.2/M2.5																							
WP3 Fish: Population status and effects of predation																																															
Task 3.1 Evaluation of monitoring of EU-listed river fish species in EU and recommendations for minimum requirements for a monitoring program					M3.1																		D3.1																							
Task 3.2 Definition of favourable conservation status for EU-listed river fish species									M3.2																			D3.2																			
Task 3.3 Assessment of the conservation status of grayling in EU									M3.3														D3.3																							
Task 3.4 Identifying environmental factors controlling predation pressure															M3.5													D3.4					M3.7												D3.4	
Task 3.5 Effects of predation on WFD assessment of ecological status of rivers																	M3.6								M3.8			D3.5															D3.5		
Task 3.6 Construct a conceptual model to identify habitat features increasing survival probability of grayling									M3.4																																					
WP4: Fish protection options																																														
Task 4.1 Establishing a sound basis on the possibilities of rebuilding fish populations by controlling cormorant-predation.							M4.1/M4.2												M4.4												M4.5						M4.6/M4.7											
Task 4.2 Provide knowledge on how landscape factors hamper or promote cormorant predation success							M4.3												M4.4												M4.5						M4.6/M4.7											
Task 4.3 Determining the foraging range of cormorants and their response to scaring attempts																			M4.4												M4.5						M4.6/M4.7											
Task 4.4 Synthesize and elaborate guidance on how the good conservation status of endangered fish species can be reached.															D4.1																										D4.2		M4.8		D4.3	
WP5 Impact																																														
Task 5.1 Communication and Dissemination Plan					D5.1																																									
Task 5.2 Communication activities					M5.1																		D5.2																						D5.3		
Task 5.3 Dissemination activities																																									D5.4					
Task 5.4 Policies, Citizens & Stakeholders Engagement																							D5.6																				D5.5/D5.7				D5.8	

From the budget-files it can be seen that WP-4 use significantly more resources in terms of money and man-months that the other three WP's. This is because most of the work intense field-activities lies within this WP. In WP-3, there are also field-work, but here there is a considerable additional (11 months) in-kind contribution of work months from the PI, Carola Winkelman. The project also greatly benefits from a high number of volunteers giving uncountable work hours to the tasks of counting birds and patrolling rivers.

Table 3.1g: 'Subcontracting costs' items

Participant Number/Short Name P3, AU		
	Cost (€)	**Description of tasks and justification**
Subcontracting	11.456	This subcontract includes expenses to cover cormorant monitoring (surveys) in European countries where these are not organized and available (e.g., Latvia, Rumania). These counts will have to be completed by national observers (companies and/or organizations) familiar with the national distribution of cormorant colonies and cannot be undertaken by partners in the project.
Participant Number/Short Name P4, BOKO		
	Cost (€)	**Description of tasks and justification**
Subcontracting	40.000	The subcontract covers services for the management of cormorants in the Drava case study (Task 4.1 in WP4). The services have to be provided by the hunting community and consist of controlling the occurrence of cormorants in the study area. The task has to be assigned to the hunting community as a service, as it requires the appropriate training (hunting licence) as well as presence on site.

Table 3.1h: 'Purchase costs' items (travel and subsistence, equipment and other goods, works and services)

P1. DTU	**Cost €**	**Justification**
Travel and subsistence, WP1, WP3	**24.000**	Participation in project meetings; 2 persons to 5 project meetings (10,000€), as well as 3 conferences for 1 person (3500€), workshops (4) and assistance with local field-work, 5 working trips for coordinator is planned (10,500€).
Equipment WP4	**45.000**	6000 PIT-tags (12.000€), 2 PIT-ground scanners (6000€), survey kits for rivers (6000€), 20 game cameras (14,000€), Materials for setup of caged cormorant experiments, AQUA (7000€).
Other goods and services WP1, 3, 4 & 5	**213.000**	Compensation for volunteers/citizen science - travel/driving (25,000€). Assistance + use of premises at AQUA (5000€). Organisation of 5 annual projects meetings (5* 12.000= 60,000), stakeholder conference, EU Parliament hearing, concluding project conference for all interested (115,000 €). Certificate of Financial statement (3000€). Publishing/open access: 5,000.
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**282.000**	
P2. UK	**Cost €**	**Justification**
Travel, WP1, WP3	**18.800**	Travel costs for 3 persons to 5 project meetings (10,800€), Travel expenses for field work (3,200€), Travel for PhD and Post Doc to one national and one international conference each (4,800€).

Equipment WP3	**19.000**	Nets for field experiments (12,500€), small equipment (e.g. waders, game cameras, 2,500€), consumables for field work (4,000€).
Other goods and services, WP3	**25.850**	Acquisition of grayling eggs (5,000€), Rearing and stocking grayling in the experimental stretches (17,850€) Certificate of Financial statement (3000€).
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**63.650**	
P3. AU	**Cost €**	**Justification**
Travel WP1,2	**18.000**	Travel costs for 2 persons to 4 project meetings (12,000 EUR) and travel costs for team of 5 researchers/technicians capturing cormorants in Central Denmark (6,000 EUR).
Equipment WP2	**31.000**	Purchasing GPS-transmitters and attachments for tagging cormorants (25,000 EUR) + field equipment to capture, handle and ring the captured birds (6,000 EUR).
Other goods and services WP1	**5.000**	AU bookkeeping, Certificate on Financial Statements, Publishing, CFS (5,000 EUR).
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**54.000**	
P4. BOKU	**Cost €**	**Justification**
Travel WP1,4	**40.000**	Travel expenses for project meetings. 2 persons to 5 project meetings (10,000€), 2 conferences for 1 person (3,000€), Travel expenses for field-work (27,000€).
Equipment		
Other goods and services WP1, 4	**70.375**	Purchase of PIT tags for tagging grayling and material costs for electro-fishing campaigns for all field seasons (EUR 65,000). Other costs and services of BOKU for auditing (EUR 5,375).
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**110.375**	
P5. BCC	**Cost €**	**Justification**
Travel WP1, 3	**22.320**	Travel subsistence during the field work (1,920€), hotels and pensions for field work and dissemination stays (4,800€), fuel and institute car costs for the field work and dissemination trips (12,600€), travel costs for 1 person to 5 project meetings (3,000€).
Equipment WP3	**31.184**	Cameras (4,000€) and cages (8,000€) for habitat complexity experiments, material for physical barriers (4,000), camera traps + SD cards (6,336€), batteries (4,608€) for fish protection river experiments, other small equipment like external hard discs for data storage, power banks, habitat complexity structures etc. (4,240€).
Other goods and services WP1,5	**10.000**	Manuscript English corrections by native speaker + Open Access charges.
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**

Total	**63.504**	
P7. CNR	**Cost €**	**Justification**
Travel WP1, 4	**10.000**	Participation to kick-off, intermediate and final meeting (1 person, flight, hotel, meals) 3000 Euro. Participation to 2 scientific congresses (1 person, flight, hotel nights, meals, congress fee), 3000 euro; 20 Trips for field work at the Oglio river site (2 persons, highway fees, meals): 4000 euro.
Equipment WP4	**25.000**	n. 2 Radio telemetry receivers for field experiments (21,000 euro). n. 8 game cameras (4000 euro).
Other goods and services WP4	**10.000**	n. 40 Radio tags (150 euro each): 6000 euro, Volunteers reimbursement for field support : 4000 euro.
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**45.000**	
P8. AEU	**Cost €**	**Justification**
Travel WP1,5	**15.000**	Participation in project meetings; 2 persons to 5 project meetings (10,000€), assistance of 1 person for the 4 local workshops /at least 2 conferences organised by the consortium in Europe workshops (5000 €).
Equipment		
Other goods and services WP5	**60.000**	Graphic design (incl. logo & branding, leaflet, poster, etc.) = €7,000 + website design and hosting = €10,000 + videos = €6,000 + registration fees for paying events (trade fairs, conferences, etc.) = 5,000€ + Publications costs = €5,000 + Printing & shipping of dissemination material = €2,000 + Events organisation (Final conference, at least 4 workshops: booking, catering, etc.) = €25,000.
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**75.000**	
P9. NIFRI	**Cost €**	**Justification**
Travel WP1, 4	**18.600**	Participation in project meetings; 2 persons to 5 project meetings (10,000€), as well as 2 conferences for 1 person (2500€), and assistance with local field-work, 10 working trips for coordinator is planned (6,100€).
Equipment WP3,4	**18.000**	6000 PIT-tags (12,000€), mobile reader kit and handheld proximity reader (2,500€), small equipment, e.g. waders and jackets for field works, cameras and external supply for cormorants observations (3,500€),)
Other goods and services WP4	**46.500**	Compensation for local fisheries management staff - active protection against cormorants, e.g. driving, permits, shooting, scaring, (37,500€), electrofishing support (9,000€)
Remaining purchase costs (<15% of pers. Costs)	**0**	**All purchase costs explained above**
Total	**83.100**	

Table 3.1i: 'Other costs categories' items (e.g. internally invoiced goods and services)

Participant Number/Short Name		
	Cost (€)	**Justification**
Internally invoiced goods and services		N/A

Table 3.1j: 'In-kind contributions' provided by third parties

Participant Number/Short Name			
Third party name	**Category**	**Cost (€)**	**Justification**
			N/A

3.2 CAPACITY OF PARTICIPANTS AND CONSORTIUM AS A WHOLE #@CON-SOR-CS@# #@PRJ-MGT-PM@#

In this project, many specific skills/capacities are needed, including:

- Experience and infrastructure required to conduct large-scale fiels experiments. Here, a close cooperation with local stakeholders and volunteers is required: DTU, BOKU, NIFRI, UK and BCCA.
- Experience and network to perform an EU-wide population survey on cormorants: AU, SLU
- Experience and network to aquire EU-wide environmental data on rivers and analyse these in an ecosystem context: AU, KU and NIFRI.
- Experience and access to a large network of relevant managers and stakeholders in EU: AEU, EAA, EIFAAC, AU.
- Experience and infractructure to use advanced telemetric methods (PIT, radio, GPS) to study the behaviour of birds and fish, including permissions to conduct animal experiments: DTU, AU, SLU, CNR, BOKU.

The ProtectFish consortium (9 partners) consists of 5 universities, 3 research institutes and 1 consulting company. The consortium is assembled with the purpose to reach the main goal of the project and deliver the expected outcomes. The focus of the project is the role of predation on river-fish populations, an issue with much conflict, media and political attention, but with very limited research. Thus, the partners in this consortium are among the few EU researchers who have studied natural predation on river fish. The coordinator, Dr. Niels Jepsen, DTU Aqua, has been working with predation since participation in the EU 5th framework funded FRAP-project (2002-2006), where fish and cormorants was one of the case studies. He has been active in the EU river-fish conservation arena and worked at JRC in 2006-2009 to facilitate the intercalibration process for fish methods as required by the WFD. With the support from the Nordic Council of Ministers, he has established a Nordic Cormorant-fish group, involving scientists, managers and stakeholders, with the aim of a more efficient protection of fish from unsustainable predation. He has also participated in REDCAFE, AMBER and Smoltrack, to mention EU-funded projects. **DTU Aqua** has a long-lasting close relationship with various user groups in Denmark, enabling efficient and swift activation of volunteers for field experiments like the ones planned in ProtectFish.

Carola Winkelman has established a river ecology group at the **University Koblenz (UK)** and while studying lower levels of taxa than fish, she documented pronounced cascading negative effects of predation on river ecological status due to the removal of large herbivorous fish species. This effect can very well jeopardize the implementation of the WFD, because even well-preserved/restored rivers with very good habitats may fail to reach Good Ecological Status because of "natural predation". She has great competence and experience regarding field experiments, assessing ecological status in rivers as well as in the study of cascade top-down effects and will contribute 11.5 work months in-kind.

Kurt Pinter is deputy-head of the FISH working group and his section at **BOKU** (lead by Stefan Schmutz) have a long tradition for performing large-scale field experiments as well and in their leading work in analysing large data sets regarding river ecosystems. Also in the field of river restoration, BOKU has been leading within the EU and has strong infrastructure and experienced technical staff to carry out demanding fieldwork. Kurt has been responsible for research on river management and fish ecological studies including long-term effects of hydro-morphological processes, hydraulic-engineering interventions, or conservation issues including research on population densities and dynamics, fish migration, and behavioural studies. Predator-prey conflicts have been touched in context of the fish otter and a comprehensive field study on cormorant impact on river fish. Thus, BOKU is a very strong partner regarding design and execution of large field-studies.

Thomas Bregnballe and the group at **Aarhus University, AU** have a great capacity in the study and management of waterbirds. Thomas has been deeply involved in the EU work on cormorants and is one of the leading experts regarding cormorant ecology and management. Thomas was the lead of the EU funded projects CorMan and CormoDist, and he was an important partner in the REDCAFE and IINTERCAFE projects as well as the EU 5th FWP - FRAP-project. The impressive international network, where AU is a central part, will be crucial in the organisation of collating recent data and ensure gap filling in current knowledge about the size and distribution of the population as well as about the number of cormorants being culled in EU. Annette B. Pedersen is a leading river ecology expert with a long experience in the WFD-implementation, monitoring and biodiversity-evaluations. She is also WP leader in the HORIZON 2020-MERLIN-project.

The **Polish S. Sakowicz Inland Fisheries Institute (NIFRI)** with Piotr Parasiewicz and Andrzej Kapusta is a renowned freshwater fish research center and has great experience in field-work and modelling of fish, invertebrate and avian habitat, needed in ProtectFish. Poland is a large country and has many rivers with grayling and a long history of predation problems, so it is very fortunate that we can have a major field study there.

The Water Research Institute (Istituto di Ricerca Sulle Acque IRSA) belongs to the National Research Council **(CNR)** of Italy. CNR main objectives is to contribute with its skills to the protection of waters also providing advices to management Institution at different levels (local, regional, national, international). The department of Verbania deals specifically with freshwaters, both lakes and rivers. Pietro Volta is a senior researcher leading a group with broad experience on freshwater fish ecology, inland fisheries and biomonitoring. He is involved in the WFD implementation at national level as technical advisor of the Ministry of the Environment. He is the coordinator of two LIFE Nature Project (IdroLIFE just finished and PREDATOR. Dr. Volta is also secretary of the Italian-Swiss fisheries Committee (www.cispp.org), the international committee that manages transboundary water among Italy and Switzerland (Lake Maggiore, Lake Lugano, Fiume Tresa).

The Biology Centre of the Czech Academy of Sciences, Institute of Hydrobiology (BCC), is a leading Central-European institute in research of fish sampling techniques and research of fish ecology and behaviour in various freshwater systems from small streams to large lakes and reservoirs. The group of Martin Čech also deals with the man-wildlife conflict focusing for more than 20 years on fish-eating predators like great cormorant, common kingfisher or Eurasian otter and also on impact of recreational anglers on fish communities.

The Swedish University of Agriculture, SLU is very central in Scandinavia when it comes to marine and freshwater applied research. Maria Ovegaard wrote her PhD-thesis on the impact of cormorant predation on inland fish populations and Karl Lundström has been focusing his work on predation in the coastal area and the impact of this.

ALIENOR is a Brusell based policy and communications agency, which provides tailored solutions. Aliénor has developed sound expertise in this field, particularly in relation to the EU policies concerning sea and inland waters, such as:
The Common Fisheries Policy; The EU aquaculture initiatives such as the Strategic Guidelines for the Development of EU Aquaculture; The Common Market Organisation for fisheries and aquaculture products; The Water Framework Directive.
Aliénor has created and runs the secretariat of the European Parliament Forum on Recreational Fisheries and Aquatic Environment (RecFishing Forum) since 2014. This informal group gathering EU stakeholders, MEPs and other relevant EU decision-makers has helped our clients raising awareness on the important consequences of EU decisions on their sector
European Inland Fisheries and Aquaculture Advisory Council, is an international NGO, under FAO. EIFAAC has been very active to try to lift the conservation of freshwater fish to a high political level for many years and has generously offered full in-kind participation. Due to new RTD legal agreement texts, EIFAAC cannot participate as partners, but will be participating in the role of Advisory Board Member. **European Angler Alliance** (EAA) is an NGO, representing millions of anglers throughout Europe. In recent years, EAA's focus has shifted from a rather exploitation-focussed to a conservation-focussed view. In this regard, the EAA is the closest we can come to a "fish-conservation organisation" in Europe, thus they are important part of the project, but due to administrative rules, they cannot be partners, but will work with the project through the Project Advisory Board. EAA, EIFAAC together with AEU will form the "Impact-triangle" of ProtectFish and with the huge network spanning from citizens over local managers, national NGOs to the EU political level the results from the project should be more than well-distributed throughout society.

4. Ethics self-assessment

Ethical dimension of the objectives, methodology and likely impact: In ProtectFish we are studying wild animals, both birds and fish. The focus is on vulnerable, EU-protected fish species, so we will use river fish in our experiments. The main objective is to reverse the negative trend for the EU populations of grayling, marbled trout, huchen and barbels. Thus, whenever these fish species are sampled and (in some of the field studies) PIT- or radio-tagged, care will be taken to minimize harm and risk for these fish, according to the 3R-principles. It is not foreseen or even likely that any of the activities in ProtectFish will lead to increased mortality for any of the handled fish. All partners have very extensive experience with sampling (Electro-fishing), handling and tagging of fish, so negative impact will be negligible. When it comes to cormorants, the regulation/protective shooting is intended to scare cormorants away from the research-sites, not to kill many birds. However, it is foreseen that a number of cormorants will be killed, in accordance to the rules laid out in the permissions granted. This is necessary because previous evidence has showed that to be efficient, all types of non-lethal cormorant scaring must be combined with some lethal shooting to be efficient. The EU population of cormorants is very large (> 1.000.000 individuals) and app. 70.000 individuals are culled under §9-derogations of the Bird Directive annually, so the additional culling of 10 – 100 birds in this project will not have impact on the population. All partners conducting field-work with live fish are required by European and national law to have the necessary permissions (WP 3 and 4). The same is the case for capture and tagging of cormorants (WP-2). Within the project, all legal regulations will be followed and all necessary permits obtained. The regulation of cormorants needs permissions in accordance to §9 of the Birds Directive, to be obtained by the local management authority. Electro-fishing and tagging of fish also requires specific permissions, which will also obtained from local management authorities. All necessary permits are given to the individual persons and in some cases only for a specific occasion. Consequently, they cannot be obtained for a whole scientific project. Some jurisdictions require permissions to mount and operate game-cameras/camera-traps in public accessible places and thus, where relevant the project partners must will for such permissions before setting up study-areas. Some short river stretches will be covered with nets to exclude avian predators and here it is crucial that a net type is used that avoid trapping of any kind of wildlife. Experience from Denmark shows that from 4 river sites covered with 70 mm mesh green trawl net during two winter seasons, not one incidence of animals getting tangled in the net was experienced, so we assess this risk to be very low. Below examples of relevant permission already in place: DTU: "Implantering af elektroniske sendere i fisk": j.nr. 2022-15-0201-01128 (capture and implantation of electronic tags in wild fish – permission from the national experimental animal welfare board, valid from 2022-2028) AU: "Tilladelse til mærkning af pattedyr og fugle i videnskabeligt øjemed", j.nr. SN 302-009 (Permission to tag mammals and birds for scientific purposes – permission from Danish Ministry of Environment, valid from 1995-onwards). NIFRI:

Decyzja na umyślne zabijanie łącznie do 300 osobników kormorana (75 osobników rocznie) oraz umyślne niepokojenie i płoszenie kormoranów w miejscach noclegu, w okresie lęgowym w miejscach rozrodu lub wychowu młodych, WPN.6401.1.76.2022.KW.5 (Decision to intentionally killing up to a total of 300 cormorants (75 individuals per year) and intentionally disturbing and scare cormorants at roost sites, and during nesting season in the nesting colonies, valid from 2022-2025). BCCAS: Permission from the Ministry of Agriculture of the Czech Republic that BCCAS is allowed to do experiments with animals (in compliance with the CZ law No. 246/1992 Sb.)

Compliance with ethical principles and relevant legislations:

The planned ProtectFish activities will be closely aligned with ethical principles of the participating institutions that are all linked to the EU requirement for experiments involving wild animals. Thus all activities will have to be scrutinized and accepted by national animal welfare councils/boards and the research partners own animal welfare boards before the start of the respective actions. As both sampling and tagging for fish as well as cormorants require permissions, these will be acquired and received before the project can start. For activities, not requiring official permissions, the project partners will observe and report any possible issues to the project lead and we will discuss how to handle the issues. The Consortium confirms that compliance with ethical principles and applicable international, EU and national law in the implementation of research activities not originally envisaged (or not described in detail) in the DoA will be ensured. The Consortium also confirms that any ethical concerns raised by those activities will be handled following rigorously the recommendations provided in the European Commission Ethics Self-Assessment Guidelines. #§CON-SOR-CS§# #§PRJ-MGT-PM§#

#§QUA-LIT-QL§# #§WRK-PLA-WP§#

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EIFAAC EUROPE

Rome, 23 March 2023

Subject: Protecting threatened river fish against predation (ProtectFish) project

To whom it may concern

With this letter the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) would like to express its support to the Protecting threatened river fish against predation (ProtectFish) project application under Horizon-CL6.

The project application is made by scientists from EIFAAC member countries and of great importance for the EIFAAC membership. More research and documentation of the effects of particularly bird predation on wild fish populations is needed to resolve the many conflicts throughout Europe between stakeholders, and to restore fish populations of threatened species, such as the Grayling (*Thymallus thymallus*) and North Sea houting (*Coregonus oxyrinchus*), as well as other fish populations that are being negatively affected, particularly by the increase in the Cormorant (*Phalacrocorax carbo sinensis*) population.

The research of the ProtectFish project will enable the development of better policy advice, management measures, and can facilitate habitat- and aquatic biodiversity restoration in line with the Habitats Directive (92/43/EEC) and the EU Biodiversity Strategy for 2030.

EIFAAC would be pleased to serve on the project Advisory Board, participate in meetings and assist in public outreach and dissemination (WP-5) of the results to the wider public, policy makers, fishery managers and other interest groups.

EIFAAC offers in-kind support to the project, through its Secretariat at FAO and membership network in Europe. This support will include assistance with conducting surveys among the 35 EIFAAC member countries, the organization of special sessions at EIFAAC symposia, communication on and the dissemination of research findings among the membership. The in-kind co-financing contribution that EIFAAC is able to supply is estimated at around 50 000 euros per year (in working hours, meeting venues, and project visibility support).

EIFAAC expects that the ProtectFish project will contribute significantly to aquatic biodiversity, healthy fish populations and more sustainable inland fisheries throughout Europe.

Yours sincerely,

Raymon van Anrooy

Secretary of the European Inland Fisheries and Aquaculture Advisory Commission

1/1

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Brussels, 24 March 2023

Subject: EAA support to the ProtectFish project

To whom it may concern:

We, the European Anglers Alliance (EAA), express our support for the project application *'Protecting threatened river fish against predation (ProtectFish)'* submitted under Horizon-CL6.

In Europe many fish populations are under threat from various pressures (pollution, warming, overfishing, dams, hydropower, predation and others). One pressure often 'overlooked', but very important for management, is that of bird predation. Unfortunately, the predation knowledge base is scarce. More research is needed, and the dissemination of research data and reporting, existing and new, are as important as the research itself. It is our experience that our decision makers often don't know the basics like e.g., how many cormorants we have in Europe, how much they eat per day or when or where to they migrate. They don't know, in spite that this kind of information is available, though not updated as regularly as would be needed for proper management of fish and birds.

EAA is a European umbrella organisation for national recreational angling organisations. The membership combined is ca. 2 million anglers. EAA and its member organisations have for decades stressed that fish are in trouble while birds (cormorants) are not. The reason for this imbalance is arguably that most people feel more for birds than for fish, and most people don't know what is going on under the water surface.

The ProtectFish project will deliver more of urgently required data and knowledge as well as securing the broad dissemination of that knowledge. EAA will make sure that our members and other angling organisations are well informed throughout the whole project period. This will ensure the distribution of the information in their own countries, in their own languages to their own members, managers and decision makers.

We are absolutely convinced that the ProtectFish project will provide valuable knowledge and data, which are lacking today but are crucial for reaching EU and national policy and legislative targets with regard to biodiversity in and around the aquatic environment, fish in particular.

EAA would be pleased to serve on the project's Advisory Board, participate in meetings and assist in public outreach and dissemination (WP-5) of the results to the wider public, policy makers, fishery managers and other interest groups.
EAA offers in-kind support to the project, through its secretariat in Brussels and experts at our ten national member organisations. The in-kind co-financing contribution that EAA is able to supply is estimated at around 50 000 euros per year (in working hours, meeting venues, and project visibility support).

Yours sincerely,

Fred Bloot
President of the EAA