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Comparison of legal regulation and technology level requirements, for aquaculture facilities producing rainbow trout in freshwater, in selected European countries

Aquaculture

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FOREWORD

We would like to express our deep gratitude to all our anonymous interview partners from the five different countries. Even though we were calling at the worst time of the year, you have been very patiently and readily explaining your farm operations and your view on things. Thank you! Without you, this study would have been impossible to realize. We hope that this document will be effectively rewarding you back at some point.

A special thanks to our young colleague, Stéphanie Céline Michl from GMA, for using her outstanding communication and organisation skills to perform several phone interviews and for compiling the country information and literature database.

OVERVIEW

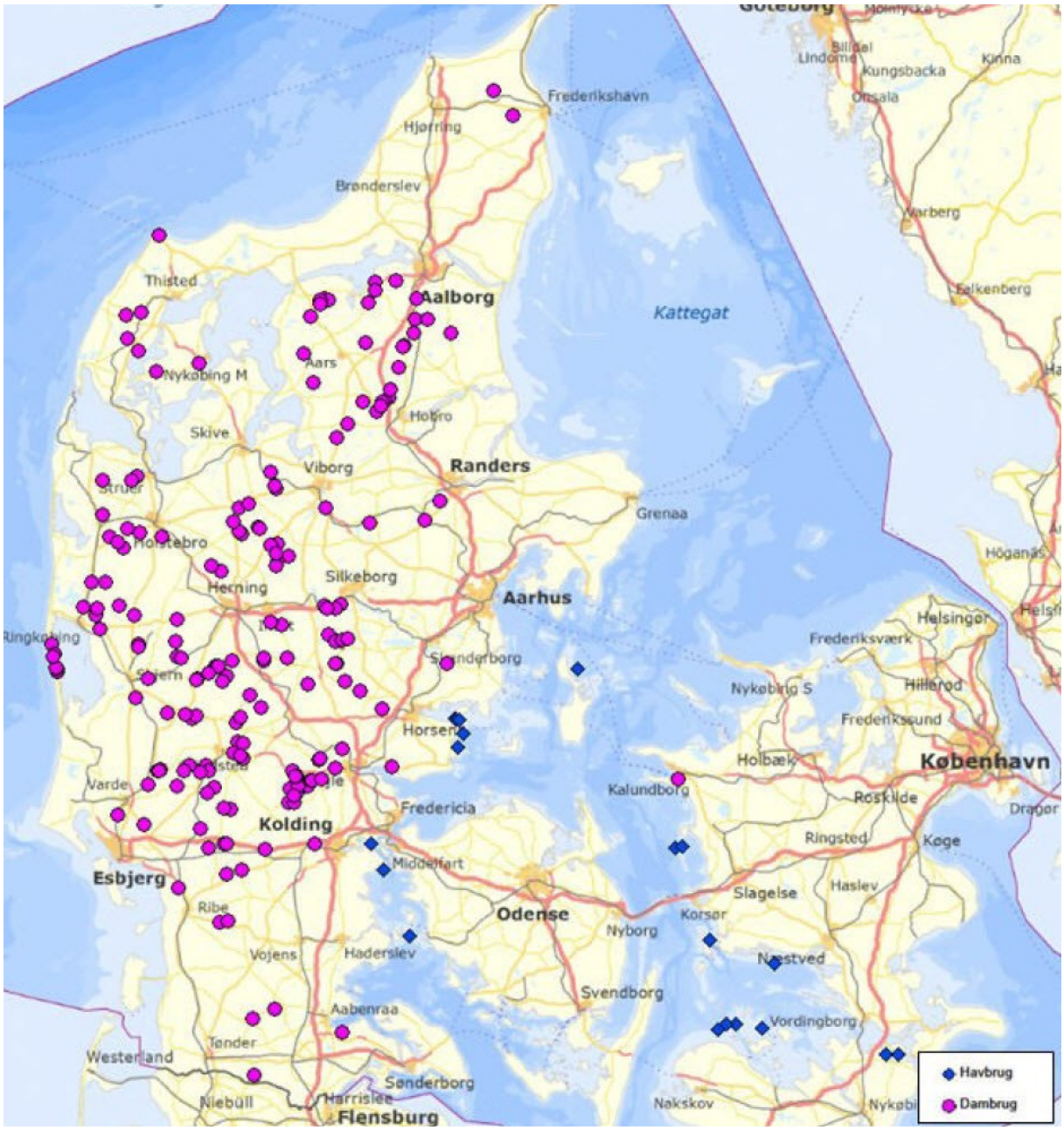

Figure 1. Danish Aquaculture facilities/farms

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1 EXECUTIVE SUMMARY

This report presents the current practice with regard to legal regulations and the level of technology used in the farming of freshwater portion-sized rainbow trout in a number of EU-member states (DK, DE, IT, PL, UK). Special reference is taken to the use of Best Available Technology (BAT) and Best Environmental Practice (BEP). These technical terms, frequently used in other (industrial) contexts, are now very relevant to aquaculture practices. Emphasis is also placed on the structural differences in permission seeking and licensing processes as well as the implementation of self-monitoring obligations.

The content of the report is based on an extensive desk-based literature study and the responses of 27 individual interview partners from the five countries under review, that were surveyed with a questionnaire between December 2015 and April 2016. The results are presented in a way that enables conclusive comparison among countries (synopsis) as well as highlighting outstanding differences between them. The data is supported by individual notions from interview partners, pin-pointing their reception/perception of environmental legislation performance and use of technology in their respective sector.

Of the five countries under review, IT has the largest annual portion-sized rainbow trout production (36.8 KT), followed by DK (29.9 KT), UK (12.8 KT), PL (11.4 KT) and DE (10.7 KT) (2013). Production volumes are stagnant and/or declining in all 5 member states. Production values range from 108.0 mio. € (IT) and 87.5 mio. € (DK) to 35.4 mio. € (UK), 33.6 mio. € (PL) and 33.5 mio. € (DE), (2013). This also indicates significant difference in sectoral profitability, which is highest in DE, mostly supported by direct marketing and sales from farms to consumers and for restocking purposes - and lesser sales to wholesale/processing. When comparing annual production volumes, number of enterprises and number of employees it can be shown that DK has the greatest production efficiency (103 enterprises / 271 employees) followed by IT (173 / 629) and the UK (193 / 643). However, the industry structure in DE and PL, with many small producers (2.542) in DE and high employment numbers in PL (5.585), precludes a direct comparability of this metric. Production types used encompass flow-through and semi-RAS systems as the most frequently used technology in all countries, followed by earth ponds and earthen raceways.

The regulatory regime affecting freshwater trout production is largely determined by the general legislative structure of the country. No country has a fully dedicated, specific aquaculture law that overrules any other legal areas. DK is the only country under review where the regional administrative bodies, i.e. the communes/municipalities, have the competence to secure that national regulations are observed – and are responsible for approval of production, even though they may only have marginal legal powers with relation to aquaculture. In the UK, powers with relation to permission for a new production and/or renewal of an existing production as well as licensing of sites are mostly concentrated at the central governments of England or Scotland (two regions under review). In PL, DE and IT, distinct regional legislative bodies have far reaching powers, especially with respect to use of water and other environmental legislation. In the latter four countries (i.e. all except DK) there is no effective harmonization of legislation at regional level. The consequence is, that farmers can be ruled by very different legislation even though they are located in the same country.

In DK, environmental approval is the legal basis of prime importance as it functions as a vehicle for almost all other legal fields. The environmental approval document combines various legal areas which in other countries would not belong to “environment” (e.g. consideration of noise emissions, water extraction and discharge, use of chemicals and medicine). This approval has a validity of 10 years and specifies the limitations and thresholds, including feed type and substances, in the highest level of detail of all the countries under review. The change in legislation in DK towards discharge-based regulation instead of feed-input is a good incentive towards the use of BAT/BEP. It was introduced on a voluntary basis, i.e. farms that are not in a position to implement the level of BAT/BEP required, are allowed to continue their production under the old legal framework. Such farms, in effect, are then slowly pushed out of the market. The 10-year validity of approvals is by no means in harmony with other factors such as the accessibility of bank loans and other structural bottlenecks to business enterprises, hence it can be assumed that DK is going to lose many of its traditional farms due to this shift.

In Germany, building law is the main vehicle for application of approval for a new production. It involves all other legal areas - environmental, fisheries, veterinary, water, animal production etc. The competent authority is located at the lowest regional level (district level, one level above city/municipality). In approval practice in DE, there is a clear distinction between extensive and intensive production that is respected by most authorities, but only considered as a guidance, not a legal obligation. The difference determines the mandatory use of certain aspects of BAT/BEP (e.g. plant lagoons, particle removal) and self-monitoring. It is largely determined by

combined consideration of volume of water intake, feed utilization and “free flow of water”, i.e. the utilization of technical installations in relation to water intake. Even though EIA law is a federal law affecting the whole country, the individual states are free to determine other cut-off values, further increasing the possible establishment of a disharmonious system.

The IT legal system for new license application lacks a carrying vehicle mechanism, i.e. all the different legal fields act independently. Building and veterinary approvals are governed on a regional level and with moderate fast processing times (in best case), whereas environmental permission is mostly affiliated with the regional or national government, inflicting long processing times of up to 2 years (typical EIA). Water intake permits are limited in their duration, sometimes only issued on a yearly basis, which results in a recurring threat of continuity of the business, not to mention the administrative burden involved in this rather unusual practice.

In PL, a comparable national/regional structure exists as in DE and IT. There exists a more orderly system of national laws affecting the relevant fields of water, environmental protection, inland fisheries, building and veterinary affairs. Water law is the main governing legal framework, which is implemented by seven regional water authorities. These specify the relevant metrics in relation to water bodies (result of implementing WFD) that lead to the specific water intake permits that are issued by the next lower authority level (district). It seems that communication between these different level of organization works quite well, even though the fact that the final say is placed at the local authority level is perceived as most likely to produce disparate rulings when viewed across the entire country.

The most proficient licensing and approval system is found in Scotland. Here, all documentation is easily accessible online and, not only due to the English language, is also accessible in a well-structured way. The requirements in terms of documentation and monitoring demands are also very high and frequently include involvement of third parties (e.g. consultancies). The recent introduction of the Aquaculture Toolbox shall increase transparency of the permission process and production statistics. Third party certification is the main driving force for the introduction of BAT/BEP and mandatory documentation.

The time taken to obtain approval for a new farm is probably longest in IT. In DE and PL, however, the interview partners were confident that it is actually not possible to get a new permission (from scratch) for a production facility that corresponds to the current state-of-the-art (systems with the highest level of RAS not taken into consideration). In the UK and DK, the process is moderately short, around 12 months, but this is mostly true for semi-RAS or flow-through with a decent amount of BAT involved. In both cases, there are ample examples where legal objections from various stakeholder groups can delay the process significantly or ultimately stop it completely. The right to file an objection in the UK is very liberal, perceived to permit objection from any dedicated interest, no matter how absurd. This increases incentive for increased transparency and communication of evidence for various categories of impact,-which is not so elaborate in the other countries.

Only DK, DE and the UK list specific requirements for certain types of BAT to be installed, mostly in relation to ensuring certain water quality limits at outlet. It is significant that in DE, the mandatory use of an outlet sedimentation device comes hand-in-hand with a reduced obligation for self-monitoring, which is perceived as a good example of a risk and evidence-based approach. The environmental risk of such small farms is very low and the functioning of the BAT (here: specified sedimentation devices) is documented (evidence) making it reasonable to exonerate the producer from overly frequent monitoring obligations.

The introduction of water treatment technology and other means of increasing production efficiency is largely governed by the incentive to reduce nutrient discharge in the available water. This phenomenon is fairly well correlated with the introduction of WFD and national implementation strategies. Even though this introduction of new technologies could easily be used as an incentive for the use of BAT, i.e. to always use the best performing technology that is available under fair and economically viable conditions, it is also frequently abused as an mechanism to overburden a rather simple production system with potentially too complex, expensive and perhaps inefficient technologies.

There are two main mechanisms that support the latter notion of overburdening requirements. The first is the static requirement of the installation of specific technologies, irrespective of the actual farm site conditions. This is especially critical in those cases where the sector is very diverse, where the production facilities operate on very different types of facility and where the site-specific conditions are highly fluctuating, e.g. seasonal differences in water flow and water quality and competition of water use with other users, e.g. agriculture. This notion was especially supported by respondents from DE, UK and PL. The other mechanism follows the ra-

tionale of trying to directly measure or monitor any nutrient discharges and water flow and to come up with a full-factorial modelling approach. Even though the theoretical achievement of such a high-level of data detail is charming and/or desirable for the authority, the rationale breaks apart when considering the costs and effort involved in maintaining such a self-monitoring effort and, what is maybe even more significant, considering how superfluous it can be when considering a proper appraisal of BAT and BEP. The BAT-technologies and BEP-practices are sufficiently well specified, so that it is always possible to get a fairly accurate calculation of the theoretical discharge values to be considered for granting the license/approval. The actual values are then of a lesser importance and should be mostly steered by stability of production and biosecurity, which typically fall under the responsibility of the farm owner and his/her individual consideration (and BMP or CoGP).

In all countries, except DK, the utilization of updated documentation of BAT and BEP, typically using another name for it, are considered the most efficient tool when communicating with the respective authority (here: typically, a municipal or communal authority with only very limited experience in dealing with aquaculture). In UK, PL and IT, these documents are regularly updated and published by producer associations. In Germany, they are less frequently updated and are developed by aquaculture experts from state authorities, typically state-driven research institutions, in close connection with producers and other experienced stakeholders. In essence, these BAT/BEP documents have the highest effectiveness and impact when they are formulated by practitioners and other experts (including scientists), when they are publicly available and visually appealing (the best examples of this found in UK and PL), and are also regularly referenced in other contexts (e.g. as an industry standard in a marketing context) as well as being living documents, i.e. under regular review.

2 ABSTRACT IN DANISH

Denne rapport præsenterer den relevante lovgivning der gælder for ferskvandsopdræt af regnbueørreder, i portionsstørrelse, i en række EU-medlemsstater (DK, DE, IT, PL, UK). Eventuelle krav til og brug af bedste tilgængelige teknologier (BAT: Best Available Technologies) og bedste miljøpraksis (BEP: Best Environmental Practice) beskrives. Herudover gennemgås strukturelle forskelle i ansøgningsprocesser for produktionstilladelser, licensaftaler samt implementeringskrav ved egenkontrolordninger.

Indholdet af rapporten er baseret på litteraturstudier og spørgeskemaundersøgelser, i de fem lande, gennemført mellem december 2015 og april 2016. Resultaterne præsenteres på en måde, der muliggør sammenligning mellem landene. Spørgeskemaundersøgelsens resultater udtrykker forskelle i nationale, regionale og personlige opfattelser af den gældende lovgivning, dennes implementering, forhold ved opnåelse af produktionstilladelse, samt påvirkning af den daglige drift

Af de fem lande har IT den største årlige produktion (36,8 KT), efterfulgt af DK (29.9 KT), UK (12,8 KT), PL (11,4 KT) og DE (10,7 KT) (tal fra 2013). Produktionsmængder er stagnerende eller faldende i alle 5 lande.

Produktionsværdier er 108,0 mio. € (IT), 87,5 mio. € (DK), 35,4 mio. € (UK), 33,6 mio. € (PL) og 33,5 mio. € (DE), (2013). Dette indikerer signifikante forskelle i rentabilitet, hvilket er højest i DE, oftest grundet direkte salg til forbrugerne (stalddørssalg) samt salg til 'put & take'.

Når man sammenligner de årlige produktionsmængder, antal virksomheder og antal ansatte, kan det ses, at DK har den største produktionseffektivitet (103 virksomheder/271 ansatte), efterfulgt af IT (173/629) og UK (193/643). Industriens struktur i DE og PL, med mange små producenter (2.542 i DE) og høje tal for beskæftigelsen i PL (5,585), hindrer en direkte sammenlignelighed.

De anvendte produktionstyper inkluderer gennemstrømningsanlæg, jorddamme og andre former for racewayanlæg samt semi-RAS-systemer (modeldambrug), som den hyppigst anvendte teknologi i alle lande. Produktion i netbure i søer foregår primært i Skotland, men dette er ikke specifikt behandlet i undersøgelsen.

Den lovgivning, som påvirker ferskvandsørredproduktion, er i høj grad bestemt af den generelle lovgivningsmæssige struktur i de enkelte lande. Intet land har en fuldt dedikeret, specifik akvakulturlov, der har indarbejdet alle andre retlige områder af betydning for akvakultur.

DK er det eneste land, i undersøgelsen, hvor de regionale administrative organer, dvs. kommuner, har fået tildelt kompetence til at sikre, at nationale bestemmelser overholdes - og er ansvarlige for godkendelse af og tilsyn med produktionen. I UK må der skelnes mellem England & Wales og Skotland, idet Skotland, baseret på den omfangsrige produktion af laks, har centraliseret sagsbehandlingen - der skelnes derfor ikke mellem laks og ørred. I PL, DE og IT har regionale lovgivende organer vidtrækkende beføjelser - især med hensyn til brug af vand og implementering af miljølovgivning. I sidstnævnte fire lande, dvs. alle undtagen DK (og Skotland) er der ingen effektiv harmonisering af lovgivningen på regionalt plan. Konsekvensen er, at producenter kan være udsat for meget forskellige lovgivning, selv om de er placeret i samme land. Danske respondenter angiver at det samme kan være tilfældet i DK.

I DK er produktionstilladelse baseret på en miljøgodkendelse, som omfatter retsgrundlaget for næsten alle andre berørte juridiske områder – også områder, som i andre lande ikke opfattes som specifikt væsentlige for akvakultur (f.eks. overvejelse af støjgener, vandindvinding og udledning, brug af kemikalier og medicin). Miljøgodkendelsen er gyldig i 10 år og beskriver de krav, begrænsninger og tærskelværdier som giver rammerne for produktionen (f.eks. fodertype og foderkonvertering). DK har dermed den mest omfattende regulering og samtidig det højeste detailniveau blandt de lande der indgår i undersøgelsen. En nylig ændring af lovgivningen i DK gør det muligt, at opnå produktionstilladelse baseret på overholdelse af en række krav til indhold i udledningsvandet fra akvakulturanlæg (udlednings-regulering) i stedet for den hidtidige regulering, baseret på foderforbrug. Med andre ord giver reguleringen incitament til investering i vandrensningsteknologier - anvendelsen af BAT og BEP, idet der ikke er noget øvre loft for produktionsvolumen, blot udledningskravene overholdes. Den nye regulering er indført på frivillig basis, dvs. bedrifter, der ikke er i stand til/ikke ønsker at gennemføre og overholde de påkrævede niveauer, kan fortsætte produktionen under de gamle juridiske rammer. Det vil væsentligst være større bedrifter der investerer i BAT og øger produktionen, mens mindre, traditionelle, bedrifter næppe kan bære investeringerne ved en sådan omlægning. En miljøtilladelse med en gyldighed på 10 år er også positiv ved optagelse af lån til sådanne investeringer. Det er derfor forventeligt at den samlede produktion

kan stige mens antallet af bedrifter falder i takt med at de mindre, traditionelt drevne, anlæg tages ud af drift. Dette er i samsvar med den aktuelle strategi for akvakultursektoren i DK. Der ydes ligeledes økonomisk støtte til etablering eller omlægning af disse 'avancerede' anlæg (nationale midler suppleret med midler fra den Europæiske Hav og Fiskeri Fond (EHFF).

I DE er det bygningslovgivningen der er den vigtigste juridiske ramme for godkendelse af en ny produktion. Godkendelse involverer dog andre juridiske områder, såsom miljømæssige -, fiskeri -, veterinære -, vand -, samt animalsk produktion. Den kompetente myndighed er placeret på det laveste regional plan (distriktsniveau, et niveau over byen/kommunen). I DE's godkendelsespraksis skelnes der klart mellem ekstensiv og intensiv produktion. Denne skelnen betragtes som en vejledning og ikke en juridisk forpligtelse, men respekteres af de fleste myndigheder. Denne opdeling/skelnen er afgørende for krav om obligatorisk anvendelse af visse aspekter af BAT/BEP (f.eks. sedimentationsbassin, plante laguner, anden partikelfjernelse) og egenkontrolniveauet. Udmøntning af krav til vandrensning bestemmes af en kombineret vurdering af den vandmængde der tages ind på bedriften, minimum vandføring i vandløbet samt foderkonvertering. Selvom der findes en føderal lov der tilsiger, at der skal gennemføres VVM (screening/redegørelse), er det de enkelte delstater frit for at bestemme grænseværdier, hvilket naturligvis øger muligheden for etablering af et disharmonisk system.

Grundlaget for produktionstilladelser i IT mangler en samlende og bærende mekanisme. Med andre ord er situationen, at de bagved liggende reguleringsområder behandles uafhængigt. Bygnings- og veterinære godkendelser reguleres på regionalt plan og med moderat hurtige ekspeditionstider. Miljømæssige forhold og tilladelser reguleres efter både nationale og regionale retningslinjer, hvilket ofte medfører lange sagsbehandlingstider – typisk op til 2 år når VVM redegørelse er nødvendig. Vandindvindingstilladelser er tidsbegrænsede - i nogle tilfælde udstedes de på årsbasis, hvilket medfører en usikkerhed for produktionen, for ikke at nævne den administrative byrde denne temmelig usædvanlige praksis medfører.

PL har en reguleringsmæssig sammenlignelig national/regional struktur som i DE og IT. Der findes dog et mere velordnet system med nationale love, der vedrører de relevante reguleringsområder for vandindvinding, miljøbeskyttelse, ferskvandsfiskeri, bygnings og veterinære forhold. Lovgrundlaget for vandindvinding udgør den vigtigste reguleringsramme, og ansvaret herfor ligger hos syv regionale vandmyndigheder. Vandmyndighederne udstikker rammerne for det ønskede vandkvalitetsmål, moniteringsbehov og grænseværdier for det pågældende vandopland (hvilket er et resultat af PL's implementering af vandrammedirektivet). De specifikke vandindvindingstilladelser udstedes af det næste, lavere, myndighedsniveau (distriktet). Det ser ud til, at kommunikationen mellem disse forskellige organisatoriske niveauer fungerer ganske godt. På tværs af PL er det dog respondenternes opfattelse, at det reelt er på det kommunale plan at afgørelser om produktion tages.

I UK er det Skotland der tilbyder det mest omfattende og kompetente system for produktionstilladelse/licensering. Her er al dokumentation let tilgængelig online på en velstruktureret måde. Krav til dokumentation og monitering er tydeligt angivet og omfatter ofte anvisninger for inddragelse af tredjemand (f.eks. konsulentfirmaer). Der gives også eksempler på udfyldte ansøgninger. Skotland har for nyligt indført dette system – Aquaculture Toolbox - som skal øge gennemsigtigheden og lette tilladelsesprocessen og samtidig forbedre produktionsstatistikkerne. I UK er det tredjeparts certificering der er den vigtigste drivkraft for indførelsen af BAT/BEP og obligatoriske dokumentation i forbindelse hermed.

I henhold til svar fra respondenter tager det længst tid at opnå en ny produktionstilladelse i IT. Respondenter fra DE og PL er overbeviste om, at det faktisk ikke er muligt at opnå tilladelse til etablering af en helt nyt 'state-of-the-art' produktionsanlæg. Fuldt recirkulerede anlæg er dog ikke omfattet af denne vurdering.

I UK og DK er godkendelsesprocesserne moderat korte - omkring 12 måneder, men dette gælder hovedsageligt for semi-RAS (modeldambrugs-typer) eller gennemstrømningsanlæg tilført vandbehandlingsudstyr (BAT). I begge lande findes rigelige eksempler på hvordan klager/anker/indvendinger fra forskellige interessentgrupper kan forsinke processen betydeligt eller i sidste ende stoppe det helt. I begge lande er ankemulighederne fra civilsamfundet meget liberale og næsten uden omkostninger for de som indgiver anken, hvorimod den opsættende virkning for produktionstilladelsen kan have store, og økonomiske, konsekvenser for ansøger. Den positive side af ankemulighederne er, at disse medvirker til at øge transparens i sagsbehandling og tydeliggør nødvendigheden af en god kommunikation med civilsamfundet i ansøgningsprocessen. Disse forhold er ikke så fremtrædende i de øvrige lande i undersøgelsen.

Kun i DK, DE og UK angives specifikke krav til hvilke typer BAT der skal/kan installeres. Kravene stilles for at sikre bestemte vandkvalitetsgrænser for udledningsvandet, hvilket kan være forskelligt fra vandopland til vandopland.

I DE er det bemærkelsesværdigt, at obligatorisk brug af en sedimentationsdam/enhed, før udledning, anses for at være sufficient for anlæg med mindre produktion. Ydermere betinger dette forhold en reduktion af egenkontrollen på de mindre anlæg. Respondenter fra DE opfatter dette som et godt eksempel på en risiko og evidensbaseret tilgang. Den miljømæssige påvirkning fra sådanne små bedrifter vurderes som meget lav og funktionen af BAT (her: sedimentering) er dokumenteret, hvilket gør det rimeligt at fritage producenten fra alt for hyppige overvågningsforpligtelser.

Generelt konkluderer respondenterne, at indførelsen af vandbehandlingsteknologier og andre midler til at øge produktionseffektiviteten er ønskelig, set med dambrugerens øjne – og under forudsætning af økonomisk rentabilitet. Omvendt er incitamentet for denne udvikling i høj grad styret af myndighedernes ønske/krav om/til at reducere udledningen af næringsstoffer og organiske partikler til recipienten. Dette 'skisma' er ganske godt korreleret med indførelsen af vandrammedirektivet og implementering af nye nationale strategier der har indarbejdet retningslinjer fra direktivet.

Videre angiver respondenterne, at indførelse af nye teknologier nemt kan bruges som et incitament til anvendelse af BAT (- med andre ord altid at bruge den mest effektive teknologi til rådighed, på rimelige og økonomiske bæredygtige vilkår) og det misbruges også ofte som en mekanisme til at overbelaste et temmelig enkelt produktionssystem med teknologier som potentielt er komplekse, dyre og måske ineffektive.

Der er to primære argumentationer der fremføres:

Første argumentation er det urimelige i faste krav om anvendelse af bestemte teknologier, uanset de aktuelle betingelser på stedet. Dette er især kritisk i de tilfælde, hvor sektoren er meget forskelligartet, hvor produktionen finder sted på meget forskellige typer anlæg, og hvor lokalitetsspecifikke forhold er stærkt svingende, f.eks. sæsonmæssige forskelle i tilgængelige vandmængder og vandkvalitet samt i konkurrence med andre brugere af vand, f.eks. landbrug. Disse forhold blev især fremført af respondenter fra DE, UK og PL.

Den anden fremførte argumentation stiller sig kritisk til rationalet i at forsøge at måle eller overvåge eventuelle udledninger af næringsstoffer og vand-flow direkte og sammenholde resultaterne med en model baseret på faktorielt design. Selvom den teoretiske opnåelse af en så høj detaljeringsgrad er tiltalende og/eller ønskeligt for tilsynsmyndighederne, bryder rationalet sammen når man overvejer de omkostninger og den nødvendige ressourceindsats involveret i at opretholde en så omfattende monitering. Yderligere synes rationalet at smuldre når man overvejer hvad det er muligt at opnå med BAT og BEP. I dag er BAT-teknologier og BEP-praksis tilstrækkeligt specificerede, så det altid er muligt at få en temmelig præcis beregning af de teoretiske emissionsværdier, der skal indgå i vurderingen af en produktionstilladelse. Tilsynet kan herefter baseres på stabiliteten af produktionen og dambrugerens egenkontrol. Dambrugernes nationale foreninger kan medvirke til en sådan regulering ved udarbejdelse af godkendte BMP-systemer som indeholder dokumenterede effekter af BAT og BEP. I UK findes allerede en sådan (CoGP).

I de omfattede lande er det kun DK der bruger begrebet BAT. I de øvrige lande anvendes andre termer der beskriver de metoder som anses som de mest effektive værktøjer til begrænsning af udledning af næringsstoffer til recipienten. Beskrivelserne er ofte omfattende af hensyn til kommunikationen med den pågældende myndighed (typisk en kommune eller en kommunal myndighed med kun meget begrænset erfaring med akvakultur).

I UK, PL og IT bliver beskrivelserne af de aktuelle teknologier og metoder opdateret regelmæssigt og offentliggøres af producentsammenslutninger. I Tyskland er de mindre hyppigt opdateret og udvikles af akvakultur eksperter fra statslige myndigheder, typisk statslige forskningsinstitutioner, i tæt samarbejde med producenter og andre erfarne interessenter.

I al væsentlighed har sådanne BAT/BEP dokumenter/beskrivelser størst effekt når de udarbejdes og formuleres i samarbejde med de fremtidige brugere (dvs. dambrugere og myndigheder) med støtte fra eksperter (dvs. forskere og konsulenter) og inddrager andre interessegrupper (CSO).

Sådanne dokumenter bør være offentligt tilgængelige og visuelt tiltrækkende (de bedste eksempler på dette findes i UK og PL), og er også jævnligt refereret i andre sammenhænge (f.eks. som en standard i markedsføringssammenhæng). Dokumenterne bør være levende/dynamiske, dvs. de revideres/opdateres løbende.

3 INTRODUCTION

In recent years, the global growth of the aquaculture industry has resulted in an ever increasing concern about the environmental impacts accruing to the development of the sector [1]. The efficient use of aquafeeds is often viewed as one of the major challenges to the development of sustainable production systems. Effluent streams arising from aquafeeds comprise a solid particulate fraction including uneaten and undigested feed and faeces, and a dissolved fraction comprising metabolic by-products, principally ammonia, urea and phosphate. The quality and quantity of the effluent will vary in response to a number of factors, including the culture species, the production system, and the physical and nutritional characteristics of the feed.

This is particularly true for those intensive farming operations employing open aquaculture production systems, such as net cages placed in open-water bodies and landbased flow-through systems. This is perhaps not surprising since the bulk of the dissolved and/or suspended inorganic and/or organic matter contained within the effluents of intensively managed open aquaculture production systems are derived from feed inputs, either directly in the form of the end-products of feed digestion and metabolism or from uneaten/wasted feed, or indirectly through eutrophication and increased natural productivity.

Apart from feed nutrients/metabolites and planktonic biota, depending upon the farming system and husbandry practices employed, aquaculture wastewaters may also contain, residues of specific chemicals used within the feed as medicines or feed additives, and/or during normal farm husbandry operations, including fertilizers, particulate/non-particulate matter derived from pond soil erosion and/or from agricultural/industrial runoff/leaching (including possible aerial contaminants through precipitation), and viable aquatic pathogens, dead or diseased animals, including live animal escapees.

Traditionally, government agencies provide the legal, policy and regulatory frameworks under which aquaculture and aquafeed use is controlled. In recent years, the emergence of certification bodies, such as the Aquaculture Stewardship Council, Global GAP and the Global Aquaculture Alliance (GAA), has seen a new approach to environmental governance. In many respects these “non-state, market driven” systems now compete with traditional governmental regulators, in what some authors have termed “the privatization of governance”. While governments retain the legal mandate to regulate the industry, increasingly, these certification bodies are setting the environmental agenda in terms of influencing the behaviour of farmers and placing limitations on the environmental impacts of their activities.

The major approaches taken by government authorities for minimizing or reducing the potential negative feed related environmental impacts of farm effluents have included

- requiring the treatment of farm effluents prior to discharge, through the use of settlement basins, specific filtration devices, wastewater treatment systems, etc.
- limiting or fixing the total quantity of feed the farm is able to use over a fixed time period.
- fixing maximum permissible specific nutrient levels within the compound feeds to be used to rear the species in question.
- banning the use of specific potentially high-risk feed items such as fresh/trash fish and invertebrates, and/or only permitting the use of artificial feed.
- banning the use of certain chemicals on-farm, including specific chemical therapeutic agents/drugs and chemicals (i.e., potentially toxic herbicides and pesticides).
- prescribing minimum feed performance criteria, such as specific levels of allowable dust/fines, feed packing material, feed efficiency or nutrient digestibility.
- requiring the use of specific Codes of Conduct, including appropriate Best/Good Management Practices for farm operations, including feed manufacture and use, and environmental management.
- requiring the development of suitable farm/pond sediment management strategies for the storage and disposal of sediments.
- requiring the implementation of an environmental monitoring program.

The above diversity of policy options reflects the wide variety of farming systems and species cultivated and the different approaches used by government authorities and/or farming associations to deal with the discharge of effluents and waste waters from their aquaculture operations. Of the different countries where regulations exist, Denmark stands out as having one of the most comprehensive and stringent environmental aquaculture regulations. It is perhaps interesting to note that aquaculture production in Denmark has remained rel-

atively static since the introduction of the Danish aquaculture law in 1989. Total aquaculture production has remained constant at around 40.000 tons, of which app. 30.000 tons is freshwater production.

A more effective way to regulate the industry would be to remove the feed quotas and instead focus on regulating discharges. Under this scenario, farmers would be motivated to increase both production and investment into discharge reduction technologies; this would enable them to increase production while remaining within their discharges targets. Denmark has currently changed the regulation for freshwater aquaculture and changed the focus from feed quotas to discharges targeting.

3.1 SCOPE OF THE STUDY

The purpose of this report is to present a survey illustrating implemented legal regulations and level of technology used in farming of freshwater portion-sized rainbow trout in a number of EU-member states. The aim of this project is to present a comparison with the production conditions in Denmark (DK) compared to four other EU-member states (DE, IT, PL, UK) having a similar, competitive, production of table-sized (400-500 gram) rainbow trout.

As a result of an extensive desk-based research and a stakeholder survey, this report will present:

- A description of the regulatory regime in the concerned countries,
- A review of technology level – any requirements for specific technology and practice to be implemented to obtain permission for production,
- And an assessment of costs for obtaining a license – if any, cost associated with discharges of pollution, use of water, etc.

3.2 WFD AND MSFD BACKGROUND

The SUSAQ project (Background information for sustainable aquaculture development, addressing environmental protection in particular Sub-Title: Sustainable Aquaculture Development in the context of the Water Framework Directive and the Marine Strategy Framework Directive), was a project commissioned and funded by the Environment Directorate-General (DG ENV) and Directorate-General for Maritime Affairs and Fisheries (DG MARE) and coordinated by CEFAS. It addresses the interactions, challenges, needs and mutual benefits of aquaculture production and water quality protection, in particular in connection with the requirements of the WFD (Water Framework Directive) and the MSFD (Marine Strategy Framework Directive). The approach of this project represented an extensive review across Europe of the issues surrounding the environmental regulation of the aquaculture industry, extensive stakeholder consultation and a look forward at how the sector will develop. It represents a very valuable resource for those who seek good practice in regulation or management of the aquaculture industry, and will be used as the basis for Commission Services to develop guidance on that topic

The following text was extracted from the final report [2] and from a presentation given by SUSAQ-representatives on the occasion of the Aquaculture Common Issues Group meeting held on 15.04.2015 in the UK [3].

The WFD and the MSFD do not contain explicit obligations for aquaculture. However, the aquaculture industry has to comply with the requirements of the WFD and MSFD via the national legislation that implements those Directives in each Member State. With regard to the WFD, a significant issue is the current frequent lack of integration of aquaculture into the RBMPs. For the WFD, even if additional objectives and measures have not been explicitly included in all the relevant River Basin Management Plans (RBMPs), these objectives and measures may exist and apply. As the MSFD is in its early stages of implementation, it is too early to assess how aquaculture is being addressed under this Directive. (SUSAQ report quote [2])

Key issues for WFD/MSFD in relation to aquaculture: (SUSAQ presentation quote [3])

- non-consumptive use of water;
- reliant on good water quality;
- mitigation measures can be adopted (e.g. filters, wetlands to remove nutrients);
- discharges (e.g. nutrients, suspended solids, medicines/biocides);
- flow management (abstraction and management of flows in river systems);

- protection of water quality;
- containment effects, escapees, pathogens;
- ecological continuity;
- biodiversity & INNS introductions
- development of aquaculture within water bodies & cumulative effects;
- coherence between EU regulations and within MS;
- administrative burdens on the industry, including timescales for license applications to be processed.

Strategic Environmental Assessment (SEA) has been used to a very limited extent for aquaculture developments;

Although Environmental Impact Assessment (EIA) is mandatory only for intensive aquaculture systems, a large number of EIAs for aquaculture projects have been carried out across Europe;

Reviews of some of these EIAs shows inconsistent application of the EIA Directive between countries;

Regulation (EC) No708/2007 [4, 5] established a framework governing aquaculture practices in relation to alien and locally absent species;

Certain alien species (with a long history of aquaculture within the EU and which do not have any major adverse ecological impacts) have been derogated from the main obligations of the Regulations, except where Member States [MS] believe that such controls are appropriate.

SUSAQ [3] positive examples / conclusions from MS

- One-stop-shops and streamlining of licensing processes (e.g. Norwegian licensing system), improve efficiencies, reduce costs and the approach is consistent with the Strategic Guidelines;
- Development of strategies for aquaculture (e.g. Strategic Framework for Scottish Aquaculture, Aquaculture Development strategy for Hungary) provide a broader view on sustainable development and may assist the application of environmental protection legislation;
- Cooperation, dialogue and sharing of information between relevant authorities, fish farmers and other stakeholders (e.g. Coordinated Local Aquaculture Management Systems, CLAMS, and Single Bay Management, SBM, processes in Ireland) manages aquaculture development in a process that permits input from all interested parties;
- Spatial planning for aquaculture - The development of spatial planning for aquaculture, together with associated tools (e.g. for assessing carrying capacity), are very valuable approaches that can integrate the requirements of the WFD and MSFD.
- Consistent and proportionate application of legislation and, thus, regulation to all sectors i.e. a level playing field is required – examples highlighted referred to the concept of environmental flows, and the non-consumptive nature of aquaculture systems;
- Risk- and evidence-based approach to determining monitoring requirements (Monitoring should be limited to parameters that could effectively detect adverse impacts from aquaculture and to parameters that are necessary to support aquaculture). This action provides potential for cost-saving;
- Administrative costs should be proportionate to the administrative effort required, be adopted across different sectors, and apply the Polluter Pays Principle. Freshwater systems were cited as sometimes improving water quality in catchments. Re-licensing frequencies were variable;
- Appropriate use of the Precautionary Principle for aquaculture systems, noting the diversity of system types and species produced in EU-28, and the wide variation in level and type of impact.

SUSAQ recommendations [3] for national administrators and regulators have been brigaded under four headings, Licensing, Monitoring, Planning and Charging:

- Licensing includes: single point of contact for administration; adoption of permitting system that allows for inclusion of mitigation practices; adopt the Precautionary Principle according to current EU guidance; and provide guidance for the sector within their jurisdiction based on the relevant species/system;
- Monitoring includes: adopt a risk & evidence-based approach to monitoring; provide greater clarity on data & information to be provided by industry; adopt regulatory codes; develop & apply technical standards for aquaculture systems;

- Planning includes: provide strategic planning for marine aquaculture development to inform spatial planning processes, and include Allocated Zones for Aquaculture (AZAs); aquaculture should be integrated into RBMPs;
- Charging includes: ensure administration costs are proportionate to the sector/business that is being regulated and the 'Polluter Pays' principle is applied.

SUSAQ recommendations [3] for the aquaculture industry have been provided, split into three categories, Technology, Management and Liaison:

- Technology includes: the adoption of aquaculture system appropriate to the local environment, and the continuation of the adoption of new practices that improve sustainability;
- Management includes: taking an ecosystem-level approach to the management of aquaculture systems; adopt voluntary practices of self-monitoring and reporting, such as those seen in Codes of Practice and Certification schemes, which improve environmental sustainability outside of the regulatory framework;
- Liaison includes: Liaise directly with regulators to achieve a common level of understanding about responsible aquaculture operations

SUSAQ recommendations [3] for further research are:

- Research that provides more accurate predictive models for the fate of nutrients that originate from aquaculture sites and their cumulative effects, as well as effective ways of mitigating those impacts.
- Research to improve monitoring techniques and support the development and use of best available technology (BAT) to reduce environmental impacts.
- Research that supports the development of new, efficient and innovative water processing technology for land-based aquaculture systems (RAS).

SUSAQ recommendations [3] for the European Commission Services are:

- Develop guidance to address the biological impacts of aquaculture e.g. pathogens, non-native invasive species, sea lice in farmed salmonids, escapees and the risk of crossbreeding with wild populations;
- The EFLOWS working group consider both the environment and the development of the aquaculture sector with respect to the management of abstraction in relation to flow-through systems;
- That this project information is retained as a readily accessible and usable resource to provide information to national administrators, regulators, industry and NGOs in the future.

4 COUNTRY INFORMATION

4.1 STRUCTURAL SURVEY OF TROUT PRODUCTION SECTOR

FEAP [6] presents figures for the European aquaculture production. The table lists the latest figures regarding portion sized Rainbow Trout. Within EU-member states, the following six countries have productions comparable to Denmark and shall therefore be prioritized scope of the proposed survey: Italy, France, Poland, Spain, Germany and United Kingdom. As part of the contractual negotiations for this study, it was agreed to limit the scope of this study to a comparison of the Danish sector with the following countries: Germany (DE), Italy (IT), Poland (PL) and United Kingdom (UK). In the following sections, the four countries are introduced by the following metrics:

- overall production (volume and value)
- Species farmed
- Employment in the sector
- Economy of aquaculture in the country - specific for trout
- Structural survey of the 'portion sized' Rainbow Trout production sector (demographics, regional focus, state of consolidation, others)

Portion Rainbow Trout production (tons) 2005-2014

PRODUCTION (tons)		YEAR									
SPECIES	COUNTRY	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Portion Rainbow Trout	TURKEY	48.033	56.026	58.433	65.928	75.657	78.165	100.239	111.335	122.873	107.533
	ITALY	39.000	39.000	39.000	38.900	40.500	39.000	39.000	36.300	36.000	36.800
	DENMARK	29.247	27.028	28.527	28.050	26.374	26.538	26.538	21.895	27.591	27.591
	FRANCE	25.000	25.000	25.000	25.000	25.000	22.000	23.500	23.500	20.870	22.000
	POLAND	14.000	17.000	17.000	15.000	14.000	11.000	13.000	14.500	14.500	17.500
	SPAIN	25.000	24.000	20.000	20.000	20.000	18.000	18.000	14.400	15.000	13.000
	UTD. KINGDOM	12.500	11.000	9.955	10.000	10.000	8.950	8.900	10.996	10.000	11.000
	GERMANY	23.000	23.000	23.000	23.000	23.000	22.300	10.062	8.116	8.333	8.466
	GREECE	4.892	3.187	2.820	3.420	2.588	2.712	2.389	1.967	2.014	2.014
	AUSTRIA	1.728	1.671	1.671	1.200	1.250	1.200	1.270	1.337	1.322	1.322
	IRELAND	1.100	1.100	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	PORTUGAL	845	943	937	941	936	951	900	900	1.000	1.000
	CZECH REPUBLIK	597	600	623	614	526	476	580	388	439	426
	CROATIA	800	800	800	800	2.000	2.095	2.358	1.232	350	361
Portion Rainbow Trout Total		225.742	230.355	228.766	233.853	242.831	234.387	247.736	247.866	261.252	250.013

NOTE: These data comprise the sum of pink and white portion rainbow trout
Countries with <100T are not included (Cyprus, Hungary, Netherlands)

Figure 2 European Aquaculture Production Report 2005-2014 presented by FEAP [6]

4.1.1 GERMANY

Salmonid – farming is the most important production sector in Germany. In 2012 [7], cold water systems count for 42% of the total fisheries production volume. Warm water pond aquaculture (carps) is the second largest sector with 25%. Most of the cold water systems are located in the south and south-west of Germany (Baden-Württemberg: 4314 t, Bavaria: 4003 t; in 2012), whereas most of the warm water production takes place in the East, South-East and North-East of Germany (Saxony: 3649 t, Bavaria: 2917 t, Brandenburg: 1078 t; in 2012). Salmonid production in cold-water systems is mainly run by small to medium-size enterprises with an average production of 5-100 t per year. Only 51 companies produced more than 100 t of salmonids in 2012. The farms were mainly flow-through farms – only a few were operating with partly recirculating water bodies. 75% of the cold-water production in Germany is Rainbow trout. Portion-sized trout production was 9134 t in 2012 and approximately 1840 t were produced for restocking or angling purposes. Other species besides trout were produced with a total of 2744 t in cold-water systems (mostly Alsatian char and Brown trout). 40 to 70% of produced trout is put on the local market for direct consumers or regional gastronomy. This is the most profitable marketing strategy. To sell portion-sized trout at wholesale is not of importance for the main producing regions Bavaria and Baden-Württemberg. Lower Saxony and Thuringia however sell 70 and 40% at wholesale, respectively. In Germany the freshwater fish market is dominated by imports with 85% of the total volume.

In 2014, the German statistics department published a report summarizing the results from a major census of aquaculture, conducted in 2011 [8]. The regularly updated data of this ongoing exercise are available online [9].

The German agency for employment [10] listed, in 2013, 532 persons to be employed in German aquaculture. Unfortunately, no data is available for owners or family-members that are not working on a contractual / employment basis, but are still directly or indirectly related to German aquaculture production.

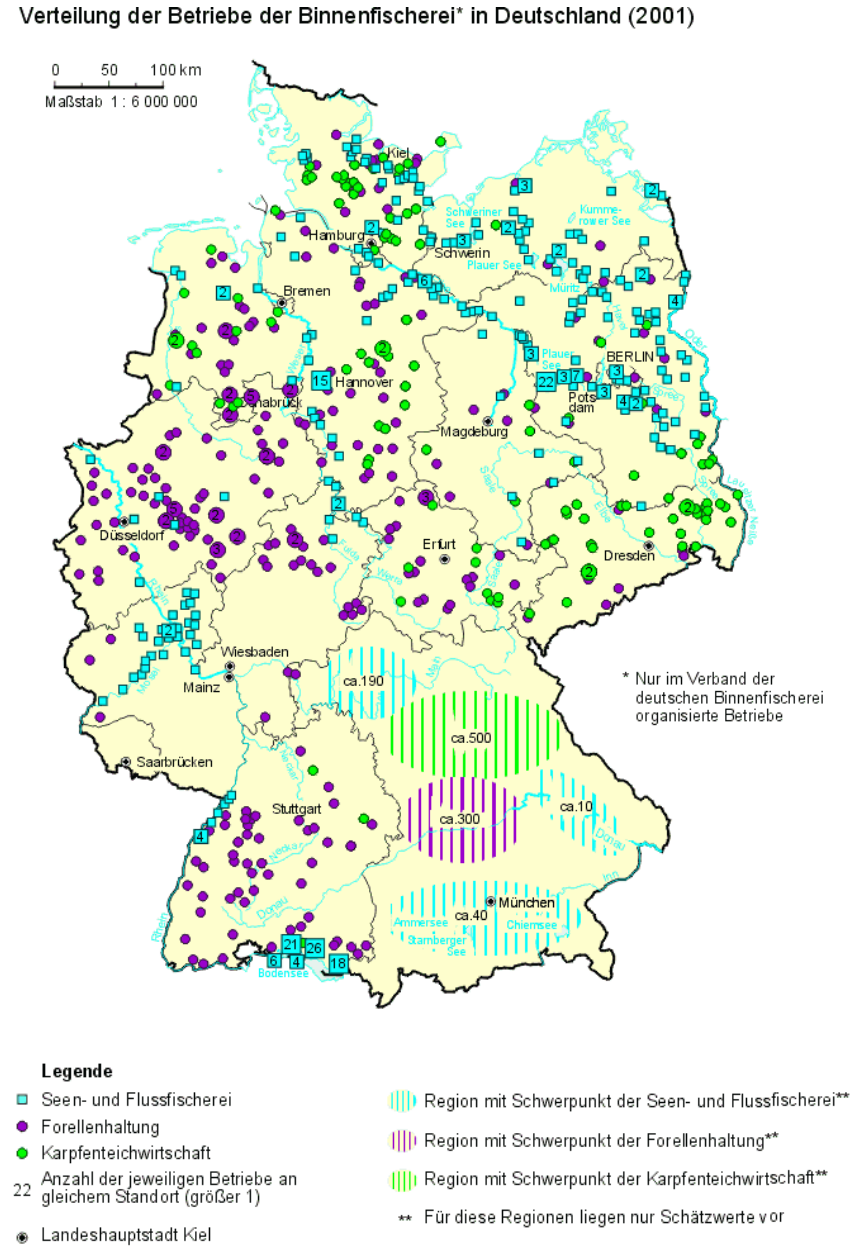

Figure 3 Distribution of German aquaculture producers (members of the VDBA producer association) in the year 2001. Trout producers and trout production areas are highlighted in PURPLE (www.vdba.de)

4.1.2 ITALY

The most important finfish production sector in Italy is trout (45.400 t in 2007). It is the 3rd largest aquaculture producer in Europe; Freshwater aquaculture in Italy is characterized by traditional small to medium size companies that are often family-run. The estimated FTE employment in this sector is around 902 units [11].

20% of the national trout production (live trout, fresh or chilled) is exported. The main markets for exports of trout are Austria and Germany. Trout products make 4.8% of the total export in terms of value [12].

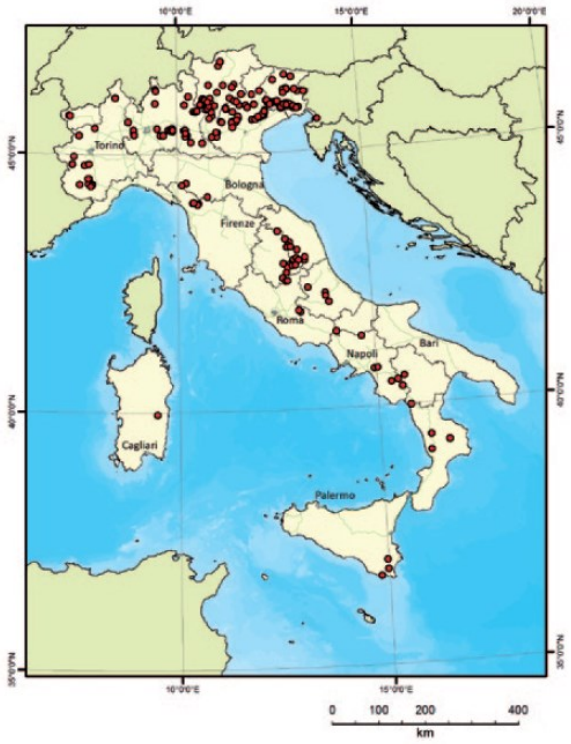

Figure 4 Distribution of trout farms in Italy. Figure adapted from [13]

Trout culture, like any other mature production activity, confirmed to be a reliable player and one of primary importance in the national and European scenario, where Italian production had to compete with production from other countries such as France and Denmark. Together with rainbow trout, brown trout and other species of salmonids, such as char (*Salvelinus alpinus* and *S. fontinalis*), are being cultured. Less fragmented facilities, along with the adoption of renewed technologies, guaranteed the sector greater verve. This was also provided by the establishment of new fresh-trout processing plants, which immediately added greater value to production. Trout farms are mainly concentrated in the North of Italy, from Piemonte to Friuli Venezia Giulia as well as along the Apennines, in particular in Umbria and in the Marche. Marche aquaculture plays a primary role at a national level thanks to trout culture, which is centred on the production of rainbow trout (*Oncorhynchus mykiss*); although there is only a single farm in the hinterland of Macerata, it represents the largest producer of rainbow trout at a national and European level. The company restructured its organisation, acquiring more than a dozen farms in northern and central Italy and implementing the entire production chain, from broodstock management to market size. It also established a commercial strategy capable of modifying and diversifying the product, in accordance with consumers demands [13].

4.1.3 POLAND

The Polish Ministry of Agriculture and Rural Development describes the Polish fisheries sector as such:

"The area of inland waters in Poland is approx. 580 thousand ha, of which lakes include 280 thousand ha, rivers 140 thousand ha, artificial dams 55 thousand ha, ponds 65-70 thousand ha and other water facilities 40 thousand ha. Of the total area of ponds in Poland, estimated to cover almost 70 thousand ha approx. 50 thousand ha is used (70%). Professional fish breeding and production is pursued by approx. 600 entities which market their quality aquaculture products. This number includes approx. 400 farms specialized in carp breeding, which make use of ponds, the total area of which exceeds 50 ha, and approx. 200 specialized and technologically advanced trout farms. Fish production is also conducted in approx. 10 thousand of farms, for which aquaculture is only one of several agricultural activities. The majority of fish farms breed more than one fish variety, which is aimed at diversification of income. Apart from common carp or rainbow trout the following other species are bred and kept: tench, silver carp, bighead carp, grass carp, sturgeon, catfish, zander, brook trout, salmo trutta m. fario, salmo trutta m. lacustris, salmo trutta m. trutta, Atlantic salmon. Some farms specialize in the production of stocking material. Apart from ponds, also other waters may be, and usually are, used as fishing grounds. The majority of them is included in public inland waters, surface waters and is divided into fishing circuits. Thus, fishing circuits are established on lakes, rivers and dams. In Poland there are 2,370 fishing circuits, which are used by approx. 800 entities. Some specialized entities authorized to catch fish use several or more fishing circuits. In fishing circuits one can catch over 30 species of fish, including mainly common bream, common roach, northern pike, common carp, vendace, perch, tench, zander, crucian carp and eel. Fishing circuits are given for use based on a tender. Tenders are open, so various entities may be authorized to fish in a given circuit: individuals, limited liability companies, social organizations or other legal entities. "(verbal quote, [14])

The development of trout farming in Poland started at the end of 1990s, and production has been stagnating over the past few years. Trout production is carried out in intensive fish production facilities and trout is harvested when it reaches the size of about 200-450g. Trout farms are located in the North, on the Baltic Sea coast, and in the south, in the Carpathian foothills. Recently, Poland has started developing more intensive land-based aquaculture and several investors have launched new businesses in the field of controlled breeding of marine or freshwater fish in indoor RAS technology (trout, sturgeon, salmon, tilapia, and barramundi). The newly established European Maritime and Fisheries Fund (EMFF) for projects in Poland allocated an amount of Euro 734 million in the period until 2020. This fund launches new financial instruments for projects within aquaculture [9].

There are some 1 050 fish farms in Poland, and production at 15% of those farms is on a relatively large scale. They include 150 trout farms. Trout production is destined principally for exports to Western Europe [15].

Inland fisheries in Poland incorporate traditionally fish farming, aquaculture and freshwater fisheries, whether for commercial or sport purposes. Around 4,000 people are involved in fish farming and inland fisheries. Growing employment potential in aquaculture facilities is related to implementation of closed recirculation systems. Unfortunately, the relative high cost of such investments combined with typical risks for production in aquaculture have influence on the very beginning of such activities in Poland [16].

Around 600 farms carry out aquaculture for commercial purposes, of which 200 farms carry out trout aquaculture. Striving to diversify their activities, over 50% of all farms are involved in aquaculture of more than one fish species (e.g. tench, big head carp and silver carp, grass carp, sturgeon, river trout, brook trout, lake trout and sea trout, Atlantic salmon) [14].

In 2012 there were 840 aquaculture land-based farms mainly carp farms. The sector is dominated by small enterprises with less than 5 employees. 59% of the Polish farms had less than 5 employees, 26% had 6-10 employees and 15% more than 10 employees. A legal form called "natural person" was dominating (81% of all aquaculture entities), next were legal persons (15%) and "other" (4%). That means that the aquaculture farms were managed mainly by micro and small family enterprises or small and medium companies. The total number of persons employed in the Polish aquaculture sector was 5,585, corresponding to 4,377 FTEs [12].

With the strong carp production, the demand for fishmeal and fish oil is below the EU level per tonne fish produced (around 258 kg fishmeal and 64 kg fish oil). In absolute terms, the sector demanded some 8,000 tonnes fishmeal and 2,000 tonnes of fish oil in 2010. Effluents of N and P per tonne fish produced are lower than in the

overall EU freshwater production (around 30 kg N, around 5 kg P). The total effluents for 2010 were estimated to be about 920 tonnes of N and 150 tonnes of P [17].

4.1.4 UNITED KINGDOM

The British trout aquaculture sector is predominantly producing in freshwater. Production is dominated by rainbow trout for food (4095 t) and for restocking (3000 t) in addition to some brown trout production for re-stocking (359 t). It is a developed specialist production sector focussing on fry and fingerlings, restocking and table trout. Production units vary in size from large 1000 tonne producers to <1 tonne. Production types used encompass earth ponds, raceways, tanks and cages. Producers are all SMEs, mainly owner/operator with an annual turnover of less than £ 1m. Some consolidation in recent years has led to fewer, larger farms. The estimated first sale value accounts for £ 19m. Trout farms are spread across a wide geographic distribution, with production areas dictated by availability of water of required quality. Hence, suitable sites are limited and the numbers are steady but declining. The whole British finfish farming sector employs around 800 FTEs. [18]

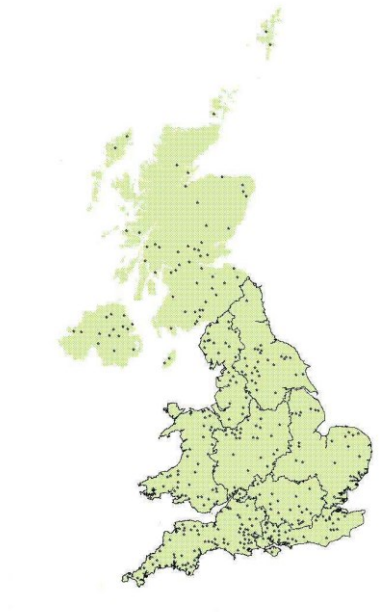

Figure 5 Distribution of trout farms in the United Kingdom. Figure adopted from [18].

In Scotland in 2014, the production of rainbow trout increased by 271 tonnes compared to the previous year 2013. Employment increased by three staff and mean productivity increased to 52.1 tonnes per person. The number of ova laid down to hatch increased by 0.1 million and the number of ova imported increased by 1.1 million [19]. In total, there were 46 active production sites for rainbow trout in Scotland in 2014 [19].

Rainbow Trout (*Oncorhynchus mykiss*)

		2013	2014
Total production	(tonnes)	5,611	5,882
Production for the table	(tonnes)	5,001	5,328
Production for restocking	(tonnes)	610	554
Number of staff employed		110	113
Mean productivity	(tonnes/person)	51.0	52.1
Number of ova laid down to hatch	(millions)	9.9	10.0
Number of ova imported	(millions)	9.3	10.4

Figure 6 Rainbow trout production metrics in Scotland in 2014. Figure reproduced from [19].

Table 1a: The UK finfish aquaculture sector in 2010

Finfish	No of sites	Volume (tonnes)	Employees (F/T)	Employees (P/T)	Employees (FTE)
England & Wales	292	9,194	844	361	1,006
Scotland	439	159,500	1,294	231	1,398
Northern Ireland	32	1,155	38	12	43
UK total	**763**	**169,800**	**2,176**	**604**	**2,447**

Figure 7 United Kingdom finfish aquaculture sector in 2010. Figure adapted from [20].

Table 2: Production for table or restocking by species and production method (excluding hatcheries & nurseries)

Production system	Species common name / FAO code	England	Wales	Scotland	Northern Ireland	Total volume (tonnes)	Estimated farm gate price (£/tonne)	Total value (£)
		(Live weight tonnes)						
Onshore - freshwater								
Ponds	Arctic char ACH	12.2		1.5		13.7	5,500	£75,350
Tanks & raceways	Atlantic salmon / SAL	8.1				8.1	26,000	£210,600
Ponds	Carp, non-ornamental / FCP	247.7				247.7	13,000	£3,220,100
Recirculation systems	North African catfish / CLZ	2.9				2.9	2,200	£6,380
Recirculation systems	Nile tilapia / TLN	135				135	2,200	£297,000
Tanks & raceways	Brook trout / SVF		0.3			0.3	11,500	£3,450
Not specified	Brown trout / TRS	447.9	28.2	46.7	50.8	573.6	5,000	£2,868,000
Not specified	Rainbow trout / TRR	7,524.5	288	3,533	642	11,987.5	2,400	£28,770,000
Not specified	Bream / FBM	6.7				6.7	15,000	£100,500
Not specified	Crucian carp / FCC	3.1				3.1	20,000	£62,000
Not specified	Roach / FRO	3.9				3.9	6,000	£23,400
Not specified	Tench / FTE	11.9				11.9	18,000	£214,200
Onshore - seawater								
Recirculation systems	Sea bass / BSS		473.2			473.2	4,500	£2,129,400
Tanks & raceways	Atlantic cod / COD			0.7		0.7		
Tanks & raceways	Turbot / TUR			0.3		0.3	6,000	£1,800
Cages	Halibut / HAL			9		9		
Tanks & raceways	Halibut / HAL			130		130	6,000	£780,000
Tanks & raceways	Atlantic salmon / SAL			195		195		
Offshore - seawater								
Cages	Atlantic salmon / SAL			153,968	462	154,430	2,860	£441,669,800
Cages	Sea trout / TRS			6		6		
Cages	Rainbow trout / TRR			1,606		1,606	2,050	£3,292,300
TOTAL								**£483,724,280**

Figure 8 United Kingdom aquaculture production for table or restocking (excluding hatcheries and nurseries) in 2010. Figure adapted from [20].

4.2 PRODUCTION STATISTICS IN TABLES

4.2.1 TOTAL VOLUMES

Yearly Comparison between Member States

Supply Chain Stage: ***AQUACULTURE***

Volumes (t)

Commodity Group	**DK**		**DE**		**IT**		**PL**		**UK**	
Years	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Bivalves and other molluscs and aquatic invertebrates	537	560	7,013	5,116	84,070	88,897			27,359	26,318
Crustaceans					6	8		0		
Flat fish		7			2	9			73	56
Freshwater fish	1,061	905	7,199	7,496	2,157	2,073	21,190	18,947	403	284
Other marine fish			436		13,874	12,873			190	252
Seaweed and other algae		180								
Salmo-nids	31,875	30,138	11,712	10,675	36,931	37,019	12,033	12,311	177,569	176,353
Total	**33,473**	**31,790**	**26,360**	**23,287**	**137,040**	**140,879**	**33,223**	**31,258**	**205,594**	**203,263**

4.2.2 TOTAL VALUES

Values (1.000 EUR)

Commodity Group	DK		DE		IT		PL		UK	
Years	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Bivalves and other molluscs and aquatic invertebrates	369	562	9,973	11,598	114,956	172,394			40,996	56,616
Crustaceans					85	117		1		
Flat fish		53			18	69			540	330
Freshwater fish	10,791	8,635	26,181	22,149	17,847	16,773	70,047	41,184	5,019	3,264
Other marine fish			1,008		109,018	94,730			1,054	1,335
Seaweed and other algae		724								
Salmonids	78,002	88,609	47,819	36,778	106,093	108,799	35,031	33,889	685,209	835,156
Total	**89,162**	**98,584**	**84,981**	**70,525**	**348,017**	**392,882**	**105,078**	**75,073**	**732,818**	**896,701**

4.2.3 TOTAL PRICES

Prices (EUR/kg)

Commodity Group	DK		DE		IT		PL		UK	
Years	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Bivalves and other molluscs and aquatic invertebrates	0.69	1.00	1.42	2.27	1.37	1.94			1.50	2.15
Crustaceans					14.17	14.57		22.45		
Flat fish		7.64			9.00	7.68			7.40	5.89
Freshwater fish	10.17	9.54	3.64	2.95	8.27	8.09	3.31	2.17	12.45	11.49
Other marine fish			2.31		7.86	7.36			5.55	5.30
Seaweed and other algae		4.02								
Salmonids	2.45	2.94	4.08	3.45	2.87	2.94	2.91	2.75	3.86	4.74
Data provided by:			**EUMOFA, based on elaboration of EUROSTAT data [21, 22]**							

4.2.4 SPECIES FARMED

Most important species (2011)

Country	Species	% of total in t	in t	% of value in EUR	in 1000 EUR
Denmark	Trout	94.2	29,885	68.5	83,623
	Eel	3.2	1,137	12.1	10,388
	Mussel	1.6	540	0.4	269
Italy	Mussel (*Mytilus spp.*)	48.6	79,520	14.9	60,257
	Trout	22.3	36,275	23.1	93,309
	Clam	19.4	32,276	31.3	126,534
	European Seabass	4.0	6,672		55,144
	Gilthead Seabream	3.3	5,508		36,507
	Eel	0.3	510		5,688
United Kingdom	Salmon	80.0	158,310	87.8	678,562
	Mussel (other mussels)	12.7	26,158	5.7	20,702
	Trout	7.3	12,679	4.6	32,974
	Others	1.0		2.0	
Poland	Carp	57.6	13,985	50.0	29,206
	Trout	34.0	14,000	30.2	33,600
	Pike	0.6			
Germany	Mussel	26.3	20,830	10.8	17,497
	Trout	28.0	10,062	44.7	33,554
	Carp	21.0	5,082	16.9	11,435

Data provided by:
- EUMOFA [23]
- EUROSTAT data [22]

Yearly Comparison between Member States - Detail by Main Commercial Species

Supply Chain Stage: ***AQUACULTURE***

Commodity Group ***Salmonids***

4.2.5 TROUT VOLUMES

Volumes (t)

Main Species	DK		DE		IT		PL		UK	
Years	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Other salmonids	243	272	1,660		148	169	697	891	11	11
Salmon		10		19			19	0	162,547	163,518
Trout	**31,632**	**29,856**	**10,052**	**10,656**	**36,783**	**36,850**	**11,317**	**11,419**	**15,011**	**12,824**

4.2.6 TROUT VALUES

Values (1.000 EUR)

Main Species	DK		DE		IT		PL		UK	
Years	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Other salmonids	901	1,094	9,828		696	827	3,030	2,835	74	71
Salmon		41		317			283	0	643,360	799,780
Trout	**77,101**	**87,474**	**37,991**	**36,461**	**105,397**	**107,972**	**31,718**	**31,054**	**41,775**	**35,305**

4.2.7 TROUT PRICES

Prices (EUR/kg)

Main Species	DK		DE		IT		PL		UK	
Years	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Other salmonids	3.71	4.02	5.92		4.70	4.90	4.35	3.18	6.73	6.48
Salmon		4.06		16.70			14.89	4.00	3.96	4.89
Trout	**2.44**	**2.93**	**3.78**	**3.42**	**2.87**	**2.93**	**2.80**	**2.72**	**2.78**	**2.75**

4.2.8 ENTERPRISES AND EMPLOYMENT

Economic and employment indicators (2012)

	DK	DE	IT	PL	UK
No. of enterprises	103	2,542[1]	173	200	193
Employment	271	532[2,3]	629	5,585[3]	643

Data provided by:

- EUMOFA, based on elaboration of EUROSTAT data [21]
- Jahresbericht zur Deutschen Binnenfischerei [7]
- Bundesagentur für Arbeit (Employment for the whole aquaculture sector in 2013; Germany: no data of owners or working family-members are available) [10]

5 METHODOLOGY

The data for this report were compiled by two different methods:

1) desk-based research and
2) a stakeholder survey by means of a questionnaire and phone interviews.

The methodologies of both methods will be described in the following two sections.

5.1 DESK-BASED RESEARCH

The desk-based research started off with an internet-based research on some relevant search operators (trout aquaculture, Europe, BAT, BEP, legislation, etc.), using Google search engine. This search was performed to scope for the different categories of anticipated repositories. The following categories became apparent:

- Publication types
  - Magazines
  - Manuals
  - Presentations
  - Reports
  - (peer-reviewed) scientific literature
  - Webpages
- Topics
  - BAT/BEP
  - Certification
  - Funding
  - License, permission
  - Policy, strategy
  - Regulations, law
  - Statistics, country information
- Country affiliation
  - DK
  - DE
  - IT
  - PL
  - UK
  - Europe
  - other

Those categories were then used to set up a literature database using the reference management software ENDNOTE (ver. X7). This software is able to perform online searches of scientific databases (e.g. ISI web of science) and to contain various types of reference entries. It is also possible to attach PDF and other documents to each reference entry. ENDNOTE can be integrated with the standard word processor (MS Office Word 2016) used to generate this report and all referencing to external sources was realized in this way.

Endnote allows for an additional level of categorisation of the type of references (column: reference type) in its database. We used those categories for two purposes: 1) to define the presentation style of the reference in the literature list and 2) to delineate (peer-)reviewed and otherwise quality controlled and endorsed literature from “grey” literature and “snapshots” (like personal comments and webpage extracts). Citation style and habit for peer-reviewed and similar references follows scientific standards, whereas referencing of grey literature was used to contribute to addressing the “stakeholder perception” aspect of this study, that was explicitly demanded by the contracting authority. The following reference types were mostly used in the database (in alphabetical order):

- book
- book section
- generic
- journal article

- legal rule or regulation
- personal communication
- report
- unpublished work
- web page

Wherever possible, author(s) and editor(s) were included in the reference. Where that was not possible (e.g. unknown author), this field was qualified with “Anon” (anonymous author) or it was qualified by the next best association to an institution (e.g. name of an institute) or a country (e.g. in case of legal texts).

Language obstacles in relation to internet-based search were overcome by our own language capabilities (DK, EN, DE) or by means of Google translate function. The latter was useful to assess the general scope of a particular source of information, to validate the correctness of the reference found/indicated elsewhere (e.g. title of legal text reference by a stakeholder) or to extract individual pieces of information (e.g. a single numerical value). We did not put trust and effort into a semantic understanding of foreign text based on automatic translation. Therefore, the Danish, English and German language information were easier accessible for us and might therefore, in some part of the report, be more elaborate than for the other two countries (Italy, Poland). This does not reflect the opinion of any party involved and contains no further implications on the complexity of the topic in question.

5.2 SURVEY

5.2.1 SCOPING QUESTIONAIRE

Based on the outcome of the initial research phase, a harmonized scoping questionnaire was developed to allow for data collection, interpretation and comparison among countries. The questionnaire was benchmarked against existing frameworks under Danish legislation and production conditions and was adjusted accordingly.

The full-spread layout of the questionnaire is given in the table below.

We call this a “scoping” questionnaire because of two reasons:

1. The length and level of detail of this questionnaire is beyond any typical format one would use in empirical social research. Its main purpose was to provide a structured guidance through the relevant topic areas that should be addressed by the final report. Realizing that the desk-based research (see above) has its particular limitations especially in grasping the opinions and perceptions of stakeholders, we deemed this “intense scoping” a useful approach.
2. The questionnaire was not intended to be by any means used for a quantitative and/or representative stakeholder interrogation. It was furthermore anticipated from the onset of the survey that not all stakeholder would reply to all questions in full extent. The absence of an answer and/or the shortcoming of a formulation in the original response was therefore not deemed as a qualifier. Instead, the answers of various stakeholders, representing a common group (e.g. country, region, production type) were grouped together and are presented as result accordingly.

Table 1 Full layout of the scoping questionnaire to survey different stakeholders.

1.			**Who are you?**
		a.	Please indicate your name, age, gender, nationality
		b.	From what position are you giving your contribution/answering the question?
		c.	What is your role / job in the aforementioned organisation?
		d.	Please indicate the most relevant metrics about your farm (annual production in tonnes, standing stock biomass, feed input per year, etc.)
2.			**Obtaining permission / license for trout production**
	2.1.		**Type of permission**
		a.	What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm?
		b.	What permission(s) is/are needed to OBTAIN the license for EXPANSION of an existing trout farm?
		c.	What permission(s) is/are needed to OBTAIN the license to establish a NEW trout farm?
		d.	Who can apply for such a permission (e.g. farm owner, producer association)?
		e.	What qualification is needed to apply (e.g. work experience as farmer, relevant degree or diploma)?
		f.	How long is a permission valid?
		g.	How frequently do you have to re-apply?
		h.	Is there a difference between “old” licenses and new licenses (e.g. license stemming from before 1992, Foundation of EU)?
		i.	If there are such “old” licenses, what are the main practical differences to new licenses?
		j.	What kind of permission do you have for your farm?
	2.2.		**Legal framework**
		a.	Which laws (laws/departmental orders/ statutory instruments/directives/guidance and/or other forms of public regulations) are applied to regulate the permission process (see 2.1)?
		b.	On which regional level(s) are these laws effective (e.g. whole country, state, region, municipality)?
		c.	How frequently are the relevant laws changed?
		d.	When was the last major / relevant change in the laws, concerning aquaculture, that you can remember?
		e.	Was this change directly related to an election or a new political party taking over the government?
		f.	What was the motivation for this change in the laws?
		g.	What was your opinion on the necessity / meaningfulness of this change?
	2.3.		**Permitting authority**
		a.	Where do you have to apply? Please give full affiliation of the MAIN permission granting authority and link to website (if applicable).
		b.	Please indicate the geographic coverage of the authority’s responsibility (e.g. for the whole country, federal state, county, municipality, ci
		c.	Which further authorities are involved in the process? Please give affiliations.
		d.	Is there any mandatory third party involvement in the application process (e.g. research institutes, state agencies, third party experts; e.g.

	2.4.		**Application process to achieve production permit**
		a.	Is there more than one application necessary to MAINTAIN a license?
		b.	Is there more than one application necessary to OBTAIN a NEW license?
		c.	Is there more than one application necessary to OBTAIN an EXPANSION of an existing license?
		d.	Can you draw a (generic) flow-diagram for the license process, beginning with the preparation of the application until the final decision?
		e.	Are there templates or guidelines available for the application? Please provide reference / source.
		f.	In which language can you / do you have to apply?
		g.	How much does the application cost (e.g. administrative fee for obtaining the license)?
		h.	Is there a fee for the license as such (e.g. fee per production volume/area, etc.; apart from any administrative cost)?
		i.	What is the official expected time to process the application (until decision – weeks? months? Or years?)?
		j.	How long does it actually take to get a license (e.g. based on the average of the last application process you know)?
		k.	What are the main causes for delays in the process (e.g. expert & public hearings, appeals, environmental impact assessments (EIA), law suits, etc.)?
		l.	Is there a legally binding maximum time the authorities can work on the application before giving a decision?
		m.	What documentation is needed for the application (e.g. map, GPS-location, description of facility, technical sketches, technical leaflets)?
		n.	If there is more than one application involved in the process, how do the applications interact?
		o.	Is there one application that is superior to the others?
		p.	Are the application processes completely separated from each other?
		q.	How do the different authorities interact with each other (e.g. based on a formalized procedure)?
		r.	What happens if one application is rejected?
		s.	What kind of written “proof” (e.g. verdict, official letter, certificate) do you receive in the end?
		t.	What is easier? Apply for a renewal of an existing license or apply for a completely new license?
		u.	What kind of application process did you have to go through?
		v.	Can you give us a copy of this document for your farm? (permit/license to produce and/or water abstraction permit/license).
		w.	What are the possibilities to complain or appeal a decision of refusal?
		x.	Does the fish farmer have to appeal himself or will the farmer’s organization do it/assist the farmer?
		y.	Will an appeal be dealt with by public authorities directly or will it be necessary to start private proceedings?
		z.	Can the expenses for an appeal be estimated?
		aa.	What is he expected time span for the appeal to be accomplished?
3.			**Relevant restrictions in relation to permission / license**
	3.1.		**Size**
		a.	Is there a production size limit for the permission (e.g. maximum production volume, feed usage, water usage, area)?

		b.	What is the maximum size of your production you are allowed to have?
		c.	Are there different requirements for different sizes of production (e.g. full EIA for a large farm, less detailed investigation for a small farm)?
		d.	What are the thresholds, if any?
		e.	In case, permissions are limited by production size, can you apply for more than one permission?
		f.	What are the conditions for doing so?
	3.2.		**Facility type**
		a.	Are there different requirements for different facility types (e.g. earthen ponds, concrete ponds/raceways, indoor/outdoor, flow-through, partly-recirculated, located in country-side or in an industrial area)?
		b.	Is there any kind of production facility that would be generally considered IMPOSSIBLE to get a permission for (e.g. see above)?
	3.3.		**Water**
		a.	How much INTAKE water are you allowed to use?
		b.	What OUTLET water composition do you have to fulfil?
		c.	Is there an ABSOLUTE (irrespective of production volume) limitation on the intake / outlet water QUANTITY (e.g. expressed as litre per second or percentage of a river flow)?
		d.	Is there a RELATIVE (in relation to production volume) limitation on intake / outlet water QUANTITY (e.g. volume per kg produced, volume per kg feed used)?
		e.	Are there ABSOLUTE requirements for the COMPOSITION of outlet water (e.g. maximum content of nitrogen, maximum suspended solids)?
		f.	Are there RELATIVE requirements for the COMPOSITION of outlet water (e.g. nitrogen discharge per kg produced)?
		g.	Are there RELATIVE or ABSOLUTE requirements for the COMPOSITION of outlet water in relation to the flow (e.g. e.g. nitrogen discharge per litre, etc.)?
		h.	Is there a fee/cost for using/abstracting the water from the river/the well? If so, what are the cost/fee?
		i.	Is any or all of the above restrictions limiting the production on your site (e.g. when your river / well has more capacity than you actually are allowed to use)?
	3.4.		**Sludge**
		a.	Is it mandatory to collect and remove sludge?
		b.	Is there an ABSOLUTE limitation on sludge quantity (e.g. tons of dry matter per year)?
		c.	Is there a RELATIVE limitation on sludge quantity (e.g. kg sludge per kg produced)?
		d.	What further usages of sludge are allowed (e.g. as fertilizer, biogas, composting, dumping)?
		e.	Is your permission / license linked to a sludge quota (e.g. maximum allowable quantity per year)?
	3.5.		**Feed**
		a.	Does your permission / license specify any limitation on the feed you use (e.g. brand, country of origin)?
		b.	Is there any specified requirement for the feed components, composition (e.g. feed specific N-, P- content, N-, P-discharge, faecal stability, digestibility)?
		c.	Is your permission / license linked to a feed quota (e.g. maximum allowable feed quantity per year)?
	3.6.		**Land / area usage**

		a.	Are you the owner of the land / area that you are using for production?
		b.	If you are not the owner, which legal status / agreement do you have with the actual owner (e.g. a lease contract)?
		c.	How does this ownership-status affect your rights in relation to production permission / licensing?
		d.	Is there an ABSOLUTE (irrespective of production volume) limitation on the area usage (e.g. expressed as ha water surface area)?
		e.	Is there a RELATIVE (in relation to production volume) limitation on the area usage (e.g. water surface area per kg produced, area per kg feed used)?
		f.	Do you have a requirement to work in different intensity levels on certain areas of your property?
		g.	What are typical spatial planning conflicts with habitats, protected areas? Please give an example.
		h.	How close is/are your farm(s) located to a protected environment (e.g. Natura2000, etc.)?
		i.	How does the site location affect the permission process (e.g. when located in or close to a Natura2000 site)? Please give an example.
		j.	Are there any areas that are PRECLUDED from trout farming (i.e. where the government really wants to have no farms)?
		k.	Are there any areas that are PRIVILEGED for trout farming (i.e. where the government preferably wants to have farms)?
		l.	Does your fish farming permission / license regulate your property usage (e.g. in terms of percentage of land that must not be built on)?
	3.7.		**Predators and other wildlife**
		a.	What "general" measures are you ALWAYS allowed to use against fish-eating predators (birds, otters, etc.) (e.g. noise deflection)?
		b.	What "special" measures are you ONLY allowed to use against fish-eating predators (birds, otters, etc.) when you are in possession of a special license or in dedicated areas or times of the year (e.g. gun shooting only with hunters' license)?
		c.	What measures are you NOT allowed to use against fish-eating predators (birds, otters, etc.)?
		d.	Which of the above mentioned measures to use against fish-eating predators are most frequently used in your country?
		e.	Is there any practical experience / scientific documentation or other source of evidence for the effectiveness of these measures in your country?
		f.	What other "problematic" interactions with other types of wildlife (other animals, plants, etc.) do occur?
		g.	How are they "typically" regulated? Please provide reference and web-link, if applicable.
	3.8.		**Energy**
		a.	Does your permission impose any requirements / regulations on your energy consumption (e.g. maximum kWh use or kWh per kg produce)?
		b.	Are there any requirements to maximum amount or demands on reduction of energy used – when OBTAINING a MAINTENANCE license?
		c.	Are there any requirements to maximum amount of energy used - when OBTAINING a NEW LICENSE?
		d.	Does your farm have a connection to the public electricity grid or do you use other means to generate electricity? Please specify.

		e.	Does your permission create any incentives / benefits to safe energy in production or to use renewable energy sources e.g. windmill, solar, etc.?
	3.9.		**Interactions with other stakeholders**
		a.	What are "typical" regulations that affect your interaction with other stakeholders, like: (Please give examples and references, if applicable)
		•	Recreational anglers
		•	Migrating fish organizations, conservation organizations
		•	Environmental NGOs
		•	Tourists and tourism industry
		•	Agriculture, farmers
		•	Water energy, power dam operators
		•	Others (please specify)
	3.10.		**Veterinary and animal welfare affairs**
		a.	How frequently are you interacting with your veterinarian?
		b.	What are the most common reasons for you to work with a veterinarian?
		c.	What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm?
		d.	What kind of veterinary approval is required to obtain the permission?
	3.11.		**Medicines & chemicals**
		a.	Are medicines only available after veterinary inspection and prescription?
		b.	Are you allowed to store veterinary prescribed medicines at your farm?
		c.	If yes to b: Under which conditions are you allowed to store medicines – and in which amount?
		d.	Is it mandatory to register the medicines in storage?
		e.	Are you allowed to apply the stored medicines at your own or only under veterinary instruction?
		f.	Is it mandatory to register the use of chemicals and medicines? If yes: How do you register?
		g.	What kind of medicines & chemicals are you allowed to use (e.g. formalin/ formaldehyde, salt, hydrogen peroxide)?
		h.	What kind of medicines & chemicals are you NOT allowed to use that you historically did use (e.g. malachite green)?
		i.	Which of these substances do you use regularly to treat your fish?
		j.	Please list the medication you normally use (based on a veterinary prescription).
		k.	Do you use vaccinated fish in your production?
		l.	Do you vaccinate yourself or do you buy already vaccinated stocking material?
		m.	Which of these substances do you use regularly for other purposes (e.g. disinfection between production cycles, disinfection of equipment)?
		n.	What are relevant limitations for the use of these substances (e.g. maximum allowable use of a disinfectant per production/per water-volume/per kg-fish)?
		o.	What special regulation exists for effluent water containing residuals from medicinal or chemical treatment (e.g. maximum residual concentration)?
4.			**Relationship between environmental impact and requirements for technology & practice**

	4.1.		**Specified Code of Practice (CoP) and Standard Operation Procedures (SOP)**
		a.	Does portion-sized rainbow trout production follow a specified "Code of Practice" (CoP) or "Standard Operation Procedures" (SOP)?
		b.	Does (freshwater, inland) aquaculture in your country follow a general CoP or SOP?
		c.	Who is responsible for the specification of CoP and SOP?
		d.	Are they published in writing and available in full text (e.g. as a book)? Please give references and web-link, if applicable.
		e.	How frequently are these documents updated?
		f.	What other media are considered eligible / equivalent to CoP and SOP (e.g. articles in fish farmer magazines, scientific reports, other publications)?
		g.	Are CoP and SOP used in training of staff and education?
		h.	Are these documents legally binding (i.e. does one have to follow these rules)?
	4.2.		**Specified mandatory technologies and practices in relation to environmental impact (BAT / BEP)**
		a.	Is there a legal requirement to use certain TECHNOLOGIES and pieces of equipment in order to reduce environmental impact? For example …
		•	Pond monk (water-level adjustment technologies, …)
		•	Aeration/oxygenation to reach a certain level of saturation before water leaves the farm again
		•	Biofilter, nitrification
		•	Removal of particles - e.g. sedimentation, Sludge-traps, fixed-bed filter, mechanical filtering system (drum filter/belt-filter)
		•	Constructed wetland/lagoon
		•	Recirculation system, RAS
		•	Others (please specify)
		b.	Is there a legal requirement to follow certain management PRACTICES in order to reduce environmental impact?
		•	How to manage foliage and plants near the ponds?
		•	How and when to flush ponds, drains?
		•	Others (please specify)
		c.	Are these TECHNOLOGIES (typically referred to as Best Available Technology, BAT) and PRACTICES (typically referred to as Best Environmental Practice, BEP) compiled in one document?
		d.	Do CoP / SOP conflict with BAT / BEP? Please give examples.
		e.	Who formulates BAT / BEP (e.g. authority, authorized organization)?
		f.	How frequently are they updated?
		g.	Do different BAT / BEP apply for NEW or OBTAIN EXPANSION permissions?
		h.	Do BAT/BEP apply regardless of thresholds (size of facility, location)?
		i.	What are the thresholds (e.g. based on size, location, authority)?
		j.	Are there regional differences in enforcement of BAT/BEP (yes/no/describe/examples)?
		k.	Is there a protected "status quo" for existing farms that saves them from implementing BAT / BEP?
		l.	Do the same "people" (authorities, institutions, associations) work together both on CoP / SOP and BAT / BEP? Please give example.
		m.	Do you have sufficient resources (e.g. access to finance, land, technology suppliers) in case additional BAT are requested for your farm?

5.			**Self-monitoring and reporting requirements on farms**
	5.1.		**Environmental self-monitoring**
		a.	What information (in relation to the above mentioned restrictions) do you routinely monitor and document yourself as a farmer? Please indicate
		•	Production size, i.e. quantity of fish produced
		•	Use of different facilities (e.g. ponds or raceways)
		•	Water (i.e. quantity and quality parameters)
		•	Sludge
		•	Feed
		•	Land / area usage (additional to facility)
		•	Energy
		•	Medicines, chemicals
		b.	How do you monitor and document (writing/filling out tables/formulas in paper, electronically using software on a computer)?
		c.	Are there regulations that specify how to do the self-monitoring?
		d.	Is there specific equipment required to monitor (e.g. special types of probes to be used for water quality)?
		e.	When, how and by whom are your self-monitoring documents checked?
		f.	How long do you need to store them?
		g.	Can you provide us with a (blank) copy of your self-monitoring documents as an example?
		h.	What happen if your self-control measures are out of bounce/beyond the limits of your license?
		i.	What are the consequences….?
	5.2.		**Environmental controls**
		a.	Who conducts environmental controls (e.g. authority, delegated institution or the farmer himself)?
		b.	How frequently are you controlled?
		c.	Are the controls announced or spontaneous?
		d.	What kind of documentation is required?
		e.	What does the controlled check (e.g. environmental index in the receiving water-body (flora & fauna indexes), other types of measuring possible impacts)?
6.			**Performance of permission**
	6.1.		**Your experience with permission**
		a.	Did you ever have to apply for a license to MAINTAIN, OBTAIN NEW or OBTAIN EXPANSION license?
		b.	How long did it take in your case to get the license?
		c.	What negative experiences did you make?
		d.	What positive experiences did you make?
	6.2.		**In your country in general**
		a.	How many NEW production licenses have been granted in the last 1, 5, 10 years?
		b.	How many existing production licenses have been CHANGED in the last 1, 5, 10 years?
		c.	In how many cases was the production volume increased?
		d.	What was the success rate of applications in the last 1, 5, 10 years?

5.2.2 DATA COLLECTION

The scoping questionnaire was sent electronically to previously identified contact persons in the respective target countries. Questionnaires were either answered in writing (inserting the response in a word text table) or by means of personal meetings, online and/or phone/video conferences.

The stakeholders were providing their answers to the questionnaire on a voluntary basis.

The Italian fish producer association (API) conducted face-to-face interviews with 10 producers / members of the association and a qualified representative of API merged those answers to a single questionnaire sent back to us.

A total of 27 stakeholders were interviewed or contributed to the questionnaire.

The data were collected in a time period ranging from December 2015 to April 2016.

The stakeholders were stemming from the following categories:

- Producer of portion-sized rainbow trout. Affiliated with / employed at a producer. Manager, technical manager, director, owner or CEO of a production.
- Consultant. Technical expert in trout production, regularly providing a technical service to a producer or others.
- Researcher. Employed at a public or private research institution. Documented expertise in fundamental and/or applied research on trout aquaculture.
- Association. Representative or functional role in a producer association dedicated to trout production or fish production. Personal qualification in technical, biological or veterinarian fields of competence.
- Public authority. Staff employed at such a public entity with a dedicated role in the national/regional legal framework of trout aquaculture regulation.

The producers were representing various different production types and annual production capacities (see table below).

5.2.3 SUMMARY OF INTERVIEW PARTNERS

Table 2 Description of the roles and background of our interview partners.

	DK	DE	IT	PL	UK
Number of interview partners	4	5	11	3	4
Stakeholder group representation	P, C, A	P, R, A, PA	A, P	P, A, R	P, A
Representing production types and capacities	semi-RAS (Danish model trout farm type 3) 100-450 to/a	Flow-through semi-RAS 200 – 600 to/a	Flow-through 20 – 1.000 to/a	Flow-through 100-200 to/a	Flow-through 60-600 to/a

- Producer (P) of portion-sized rainbow trout. Affiliated with / employed at a producer. Manager, technical manager, director, owner or CEO of a production.
- Consultant (C). Technical expert in trout production, regularly providing a technical service to a producer or others.
- Researcher (R). Employed at a public or private research institution. Documented expertise in fundamental and/or applied research on trout aquaculture.
- Association (A). Representative or functional role in a producer association dedicated to trout production or fish production. Personal qualification in technical, biological or veterinarian fields of competence.
- Public authority (PA). Staff employed at such a public entity with a dedicated role in the national/regional legal framework of trout aquaculture regulation.

6 RESULTS

6.1 Regulatory regime

In this section, we provide a review of the overall regulation affecting portion-sized rainbow trout production in the five EU states covered by this study. We limit the survey to the following legal areas, which mainly affect BAT/BEP:

- Water use and discharge
- Environmental protection and EIA
- Planning, building and access to space
- Permission to operate
- Animal health and use of chemicals/medication

Further legal areas with relevance for farm operation and production, e.g. farm security or hygiene, are only referenced when they involve apparent implications for the use of BAT/BEP.

Regulations are usually specified in law texts, which can be effective on EU, national and regional level. In some of the countries, e.g. Germany and Italy, the regions have far-reaching competencies in relation to the relevant laws, which may also overrule (or specify) national law. The consequence is, that farmers can be ruled by very different legal frameworks even though they are located in the same country. Furthermore, the legal areas are not always easily clearly distinguishable and significant overlaps exist. Depending on production site, intensity or historic background, very different legal framework may apply to different farm operations.

This problematic has previously been addressed by the industry's claim for a level playing field [24]. Recognizing that it takes a long time to change laws on those different levels of organization and acknowledging the far-reaching implications also for other affected sectors (e.g. agriculture), this struggle will not be easily solved.

A first step in this direction was recently undertaken when DG MARE invited member state competent authorities to participate in a seminar on "Good practices in administrative simplification for the promotion of sustainable aquaculture" (Brussels, 18-19 November 2015). The tangible outcomes of this technical workshop are not officially published yet, but will eventually be publicised on the DG MARE website (http://ec.europa.eu/fisheries/cfp/aquaculture/good-practises/index_en.htm). We were able to access the draft documents of this workshop and would like to highlight the following:

- The introduction of "one-stop-shops" to simplify the access to licenses and permits is underway in some MS and the first experiences are communicated to the other MS
- Spatial planning and especially announcing dedicated aquaculture production areas is mostly relevant for marine production
- Setting up a single law on aquaculture will be very challenging for some of the MS, but some are trying to do so
- Capacity building within administration is especially considered necessary in countries/regions which do not frequently deal with application processes (lack of experience)
- Some MS are in the process of setting up national platforms that provide access to good/best practice in license/permission which shall provide a certain flexibility in implementation of existing legislation (e.g. avoiding to specify definite discharge values in legal text)
- Incentivising the use of efficient water treatment systems by introduction of water use charges is an ongoing topic of discussion and diametric differences exist between the MS. Some MS formulate a lack of "strong complaint" from the industry against such charges and conclude in turn that this is not an issue. Increased use of (part-) recirculation technology is considered a positive effect of the introduction of water charges, calling it an attractive model. This topic will be addressed in a future event.
- A guidance document on the application of WFD/MSFD in MS will be published in short due. It shall provide some support also in when and how to perform EIA.

A second technical workshop is announced for 25. May 2016 to be held in close conjunction with a major aquaculture stakeholder conference (Tapping into blue growth - the way forward for European aquaculture; 24.05.2016, Brussels ; http://euaquacultureconference2016.eu/). Participation to this workshop is limited to nominated country delegates upon invitation.

Our findings are in good accordance with an ad-hoc study that was conducted by Andrea Fabris (API, Italy) in the framework of the SUSAQ project [2], on behalf of FEAP, among FEAP member organisations ([25], quote from PPT-slide: "Unnecessary/unfair burdens that fish farmers are facing related to WFD/MSFD implementation"):

- Unfair prices for the use of the freshwater (to use, it is not the pollution taxes witch is another price (ES, IT, PL)
- Lack of cooperation between administration responsible for WFD implementation and administration responsible for aquaculture development -Parallel but not coherent actions are performed regarding the strategy of effective water use on one hand and aquaculture development on the other. (PL)
- The fees for use of public maritime area are equivalent in terms of cost (1.60 €/m2) to designated areas for beach establishments that have obviously a different profitability (IT)
- Lack of universal system of defining the value of minimum acceptable flow in the river (IT, PL)

And further some examples of Good Practice (FEAP perceptions)

- Catchment and river basin management (United Kingdom).
- Freshwater Environmental Impact Unit Charging (EIUC) (England)
- Water extraction and pollution systems (Poland).
- Preservation of ponds and wetlands (Italy, Portugal)
- Restocking and maintain biodiversity (Italy, Poland, Hungary)
- Good information published by regulatory agencies and by industry (United Kingdom, Italy, France,…)

He [25] also pointed out FEAP endorsement for comprehensive good practice manuals, including area management systems, tailored for the different types of fish farming in EU and for the different species. Those documents exist in Italy and Scotland.

All five countries have in common, that different authorities acting on different regional/communal level have a say in the legal areas mentioned above. We will therefore aggregate them under these headlines, even though they might not exactly reflect the title of the respective national/regional law. It was beyond the scope of this study to review the regulatory framework in all five countries to such an extent that would disentangle all legal differences between regional laws. Instead, we pursued our survey-approach and asked our interview partners for their perception of the currently (and historic) legal framework affecting their production. The account of these perceptions is given in the section following the review (result of survey).

In the following sections, we will describe the overall legislative basis for production of portion-sized trout in the five countries. These information is based on a review of legal texts and guidelines as well as it is based on the personal accounts from the interview partners. Each country section will be subdivided into five relevant categories that we used to structure the questionnaire. In the beginning of each subdivision, we will summarize and highlight the key findings, followed by the consolidated (and anonymized) responses of the interview partners.

6.1.1 DENMARK

A new statutory order for freshwater fish farming was introduced in 2012 [26].

6.1.1.1 OBTAINING PERMISSION / LICENSE FOR TROUT PRODUCTION

The most relevant permission that a trout farmer in Denmark has to obtain is the Miljøgodkendelse (Environmental Permission). The permission document combines various legal areas which, by the logic of other countries, would not belong to "environment" (e.g. implications on noise emissions, water abstraction and discharge, use of chemicals and medicine). The application process is steered by the same authority (here district) and this authority is responsible for including the other legal areas and the respective authorities. In this respect, the environmental permission is a vehicle for the whole process. Only the planning and building permission is exempted from this. Because it was not specifically mentioned by the interview partners, it is assumed that this is not a burning topic for them.

The environmental permission that our interview partners showed us, can be as much as 70 pages long, when it covers an EIA and a habitat assessment in the same document. The document is structured as report, starting with a historic summary of the fish farm operation and a description of its main production activities and other (side-)activities, like running a hatchery. It also contains a description of the general parameters and practices on site, in relation to environmental law, e.g. the type of water supply, known effect on the water body. It describes the reason for the application (e.g. seeking a change from feed- to discharge control based on the previous granted feed quantity, an exception for the obligation to use impermeable materials, permission to use medicines or chemicals). The permission is then granted with reference to the respective Danish laws with a legal security of 8 years and a validity of 10 years before a renewal shall be sought. Then there follows a detailed description of the specific thresholds and limits that the permission is based on and that the farmer is obliged to respect. These encompass i.a. reference to feed type, effect on biodiversity near the water outlet, outlet water composition and oxygen content, the level of self-monitoring, maximum annual and daily (based on 7-day average) total-N and total-P quantity (kg) and maximum average net concentration (U_k) of BOD5 (mg/l) and ammonia-N (mg/l). Furthermore, season-specific (Apr-Sept and Oct-Mar) maximum thresholds for BOD5 and Ammonia-N are given. The formulas for calculating the different thresholds are explained. There are given tables containing average and peak thresholds (mg/s) for substances (e.g. formaldehyde, copper, Chloramin-T, antibiotics) and dosage instructions for those. It contains specification for noise (db(A), time of the day) and vibrations, smell, waste and sludge.

The level of complexity of this environmental permission document is an indication for the challenges a fish farmer in Denmark faces in the process of seeking permission for production. It becomes apparent that neither the formulation of the application text nor the preparation of all necessary background information/drawings/assessments etc. can be realized by a single person who is running a fish farm for living. Even though the involvement of third party consultants is not explicitly mentioned in the laws (as far as we could see), it is a de facto obligation for the applicant to hire consultants and other experts to prepare the application for him. The costs for this are significant.

Quote from EPA website [27]

> In 1989, the Danish government enforced regulations on freshwater fish farms, resulting in a reduction in discharges of organic materials, nitrogen and phosphor to about half.
>
> Freshwater fish farms are now regulated according to the new Statuary Order for Fish Farms nr. 130 of 8th of February 2012 (In Danish: bekendtgørelsen om miljøgodkendelse og samtidig sagsbehandling [26]), and an environmental approval (Environmental Protection Act [28], chapter 5). Water intake is regulated by the Water Supply Act [29].
>
> This new statuary order for fish farms combines 3 statuary orders into 1 (statuary order for Fish Farms, statuary order for model type 3 fish farms or similar installations as well as the statuary order for simultaneous processing of permits for freshwater fish farms).
>
> The main goal of the new statuary order for fish farms is to create incentives for the fish farmers to produce more fish while reducing their environmental pollution.

> Expansions and other changes of a freshwater fish farm, which will lead to an increase in pollution, have to be approved according to chapter 5 in the Environmental Protection Act.

The most relevant recent law change in Denmark with a direct effect on trout production was the change in the freshwater fish farm law (Bekendtgørelse om miljøgodkendelse og samtidig sagsbehandling af ferskvandsdambrug [26]; for English version [30]). By this law it became mandatory for newly permitted fish farms to be assessed by their nutrient discharge (and its potential effect on the environment) instead of by its feed quantity. The reason for this change was to set an incentive for the utilisation of water treatment technologies and to reduce the production specific discharge. The rationale behind this approach is, that the farmers are free to produce as much fish as they can, as long as they maintain the water quality (discharge limits) of their effluent water. This paradigm-change in Danish trout aquaculture regulation implies not only a strong push forward for the use of (part-) recirculation and other means of BAT/BEP, but also a significant increase of the (self-) monitoring throughout the production.

Existing farms with a valid production permit based on feed utilisation can apply for a change to discharge control, but (translated and quoted letter from Miljøstyrelsen to all municipalities with aquaculture [31], English version [32]) :

> "The municipality council must treat these applications in the same manner as if they were non-environmentally approved fish farms. If the Municipal Council, in connection with earlier environmental approval, has approved a reduced feed-quota, compared to the original allowed feed-quota, these stricter conditions must continue to be in force, unless the Municipal Council finds that the stricter conditions no longer are necessary.
>
> For the fish farms that do not have an environmental approval, and who wish to remain on the regulation on the basis of feed consumption until the next review, it is apparent from paragraph 12(1)1 [26], to the Municipal Council in environmental approval shall lay down conditions concerning the maximum permissible feed consumption. It follows from this, that the Municipal Council by the setting of conditions on the maximum permissible feed use must take as its starting point the fodder authorisation the fish farming has received in accordance to its freshwater farm notice. Where it is objectively justified, can the local authority on the basis of a specific assessment sharpen terms on feed consumption in relation to the previously announced fodder authorisation".

Taking into account local conditions, the environmental approval also includes aspects of Best Available Technology (BAT), e.g., farm construction and operating equipment, including cleaning devices, limitation of water consumption from the water course, feed composition and feeding management, process technology, oxygenation, vaccination, and use of medicine and chemical additives. In connection with achievement of the required environmental approvals, most traditional trout farms have become more technological; they use varying degrees of water cleaning treatment, re-use of water, aeration, and oxygenation to meet the requirements. No standardized techniques have been applied, as fish farmers often use locally developed solutions.

The permission system in Denmark foresees the possibility to appeal to a specialised board. Interview express their experience in the questionnaire below. Here is some background information on the functioning of this entity. (http://nmkn.dk/om-naevnet/in-english/ ; verbal quote):

> The Environmental Board of Appeal is the central board of appeal for all matters relating to nature, planning and the environment. We review the practical application of the law. Our remit, taking the legal rights of citizens and enterprises into consideration, is to make the correct decisions efficiently and effectively. The purpose of the work is to assist citizens and enterprises in clarifying as quickly as possible their situation with regard to use of land, pollution of soil, industrial cases and permits for livestock farms.

Table 3 Questionnaire. DENMARK. Section 2.

2.1. Type of permission	
a. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	A renewal of the Environmental Permissions and a new water permission including an EIA (screening or full assessment)
b. What permission(s) is/are needed to OBTAIN the license for EXPANSION of an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Environmental Permissions including an EIA (screening or full assessment) including a new/renewed water permission.
c. What permission(s) is/are needed to OBTAIN the license to establish a NEW trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Environmental Permissions including an EIA (screening or full assessment) including a new/renewed water permission.
d. Who can apply for such a permission (e.g. farm owner, producer association)?	The farm owner, or his representative (consultant, organisation etc.)
e. What qualification is needed to apply (e.g. work experience as farmer, relevant degree or diploma)?	Knowledge in fish farming technology and environmental impacts and regulations - but no formal educational/skill demands
f. How long is a permission valid?	An environment permission is reviewed every 10 years. A water permission is valid in 10 years.
g. How frequently do you have to re-apply?	
h. Is there a difference between “old” licenses and new licenses (e.g. license stemming from before 1992, Foundation of EU)?	Yes, the rules are changing all the time. Old Licence are without any Habitat Impact Assessment, EIA (VVM) etc.
i. If there are suc1h “old” licenses, what are the main practical differences to new licenses?	Old Licence are without any Habitat Impact Assessment
j. What kind of permission do you have for your farm?	Environmental approval, Water extraction license. Veterinary- infectious-level (to be controlled/renewed every year)
2.2. Legal framework	
a. Which laws (laws/departmental orders/ statutory instruments/directives/guidance and/or other forms of public regulations) are applied to regulate the permission process (see 2.1)?	Environmental Law [33] Freshwater Fish-farm order [26] Water Supply Law [29], Habitat Law and orders [34] Planning Law [35] EIA order [28], Nature protection Law [36] and some other orders.
b. On which regional level(s) are these laws effective (e.g. whole country, state, region, municipality)?	Whole country
c. How frequently are the relevant laws changed?	Quite often but often the changes are not aquaculture relevant.
d. When was the last major / relevant change in the laws, concerning aquaculture, that you can remember?	Freshwater fish farm orders in 2012 [26]
e. Was this change directly related to an election or a new political party taking over the government?	No
f. What was the motivation for this change in the laws?	The motivation was to change the regulation from feed quota regulation to outlet regulation, and to implement new technology and BAT.
g. What was your opinion on the necessity / meaningfulness of this change?	It was high time to change the regulation, however, there were so many legally and technical errors and misunderstandings in the order that it is virtually useless for many production forms (fish farms). We have long awaited a new order.

2.3. Permitting authority	
a. Where do you have to apply? Please give full affiliation of the MAIN permission granting authority and link to website (if applicable).	Local municipality (Environmental approval & water abstraction permit) Nature Conservation Board: If the farm is located in or near protected area, or area with restrictions of importance for the fish farm.
b. Please indicate the geographic coverage of the authority's responsibility (e.g. for the whole country, federal state, county, municipality, city).	Municipalities. In Denmark there are 98 municipalities.
c. Which further authorities are involved in the process? Please give affiliations.	New farms further have to have a veterinary authorization (according to EU-dir 88/2006 [37]). This is done after visit and evaluation from The Danish Veterinary and Food Administration
d. Is there any mandatory third party involvement in the application process (e.g. research institutes, state agencies, third party experts; e.g. for statements, review of application)?	No, but there is 4 week hearing period for a permission for relevant authorities, organisations, neighbours, NGO etc.
2.4. Application process to achieve production permit	
a. Is there more than one application necessary to MAINTAIN a license?	An Environmental Permission and a water permission including an EIA.
b. Is there more than one application necessary to OBTAIN a NEW license?	Water permission and Environmental Permissions including an EIA (screening or full assessment). Apply for Veterinary permission.
c. Is there more than one application necessary to OBTAIN an EXPANSION of an existing license?	Water permission and Environmental Permissions including an EIA (screening or full assessment). Apply for Veterinary permission.
d. Can you draw a (generic) flow-diagram for the license process, beginning with the preparation of the application until the final decision, including all parties involved and the main milestones (see example in Appendix page 180)?	
e. Are there templates or guidelines available for the application? Please provide reference / source.	Yes, there is a guideline for environment permissions http://miljogodkendelsesvejledningen.dk/indhold/
f. In which language can you / do you have to apply?	Danish
g. How much does the application cost (e.g. administrative fee for obtaining the license)?	The cost for making an application (renew or change a former fish farm) can vary between 10.000 – 100.000 kr. Or even more if the farm has to make a full EIA. The administrative fee varies also a lot depending on the complexity of the permission and from one authority to another – but normally in the range between 30.000 kr. – 100.000 kr.
h. Is there a fee for the license as such (e.g. fee per production volume/area, etc.; apart from any administrative cost)?	No fee
i. What is the official expected time to process the application (until decision – weeks? months? Or years?)?	3-12 months. Some applications take even longer – sometime several years.
j. How long does it actually take to get a license (e.g. based on the average of the last application process you know)?	There is no experience with new licence to traditional fresh water trout farms during the last 20-30 years. A licence for building a new RAS fish farm takes 1-2 years.
k. What are the main causes for delays in the process (e.g. expert & public hearings, appeals, environmental impact assessments (EIA), law suits, etc.)?	For RAS farms it will take some months to get a planning permissions if the area is not reserved to fish farming industry in the spatial planning (Byplan, lokalplan), Then the EIA (VVM and Habitatkonsekvensvurdering) take several months. The public hearing takes 4 weeks. If there are any appeals, then the process in the appeal board can take 1-2 years.

l. Is there a legally binding maximum time the authorities can work on the application before giving a decision?	No
m. What documentation is needed for the application (e.g. map, GPS-location, description of facility, technical sketches, technical leaflets)? (See also questions to the use of specific technologies in section 2 and 3, below)	1: Map of the area including any annexes. 2: Technical description for documentation/render probable that the layout and technical equipment will serve to keep the pollutant (N, P and BOD) in the outlet-water within the given limits. Feed and outlet calculations (N, P, BOD, medicine and chemicals), BAT discussions, impact on habitats, and documentation on other environmental impact 3: Calculations for chemicals/auxiliaries and medicines, expected to be used. 4: Permit/license for water-extraction must be obtained and presented when you apply for environmental license. 5: Garbage, sludge, noise, working hours, transport activities etc.
n. If there is more than one application involved in the process, how do the applications interact?	There are many applications involved: environmental permissions, water inlet permission, planning permission and in some cases nature permission (Habitats). The applications interact and there will be given a coordinated permission.
o. Is there one application that is superior to the others?	No, the laws are equal.
p. Are the application processes completely separated from each other?	No, the application process is coordinated.
q. How do the different authorities interact with each other (e.g. based on a formalized procedure)?	For fresh water fish farms it is the same authorities taking care of the applications involved.
r. What happens if one application is rejected?	Normally the project will change so it will fit into the demands from the different laws and regulations. Overall, if one application rejected, then all is rejected.
s. What kind of written "proof" (e.g. verdict, official letter, certificate) do you receive in the end?	A permission with all the requirements which must be complied, as well as a technical, professional and legal justification for the permission.
t. What is easier? Apply for a renewal of an existing license or apply for a completely new license?	Apply for a renewal of an existing farm (e.g. modernisation) is the easiest. There is no experience for applying for a new (traditional) freshwater fish farm in Denmark during the last 20-30 year.
u. What kind of application process did you have to go through?	Applied for renewal – and change from feed-quota to outlet-monitoring (see initial text at the beginning of this section). 1: Water-extraction permit 2: Environmental licence 3: Meet the water-quality-requirements for the receiving water-body (river). 4: Fauna-index (saprobic-index) up-stream and down-stream (using Danish Streamfauna Index [Dansk Vandløbs Fauna Indeks])
v. Can you give us a copy of this document for your farm? (permit/license to produce and/or water abstraction permit/license).	NA

w. What are the possibilities to complain or appeal a decision of refusal?	The fish-farmers has no possibilities to complain or appeal before he has achieved the Environmental Licence! Then he can redo the application in accordance with the notes from the municipality council. All decisions, permissions or refusal can be appealed within 4 weeks to the Environmental Board of Appeal; for farmers, NGOs, authorities, neighbours and everybody with a specific interest in the case. There is a fee 500 DKK for an appeal, and if you win the appeal you will have your fee back. If, for some reasons - some municipalities do not have the necessary skilled employees, or the employees maintain their own resistant-policy against fish-farming - this process can be delayed (for years). The fish-farmer can complain to the superior officer at the municipality administration. Most often the only possibility the farmers have is to make contact to local politicians and ask for their (lobbying) assistance.
x. Does the fish farmer have to appeal himself or will the farmer's organization do it/assist the farmer?	The farmer or anyone representing him. If Water-extraction permit is not attained or if the application has not been fully met, an appeal can be sent to the Environmental Board of Appeal Otherwise appeal is only possible when you have an Environmental Licence (with which you are not satisfied)
y. Will an appeal be dealt with by public authorities directly or will it be necessary to start private proceedings?	1: The municipality will have to send their verdict in a public hearing (for 4-8 weeks) 2: If someone will appeal the verdict it has to be appealed within the timeframe – otherwise the possibility to appeal is lost. 3: BUT, the sport angler's association and the nature conservancy association has the opportunity to ask for a prolonged deadline for their appeals. 4: In principle, the fish-farmer, can handle the appeal himself, but very few is capable of this, thus hiring consultants or ask the Fish Farmers Association to involve and act for him.
z. Can the expenses for an appeal be estimated?	Formally the fee is just 500 DKK to ask for appeal at the Environmental Board of Appeal, and if you win the case, you will have the fee back. Then there are expenses if the farmer has to deliver more technical or juridical input to the case. So, in reality, the amount will grow over time – paying consultants and missing income for lost production. Often amounts up to 50.000 DKK is paid to consultants/lawyers.
aa. What is he expected time span for the appeal to be accomplished?	From ½ to 10 years

6.1.1.2 RELEVANT RESTRICTIONS IN RELATION TO PERMISSION / LICENSE

As outlined in the first part of this report (country description), the Danish trout production sector is based on a fairly homogenous use of production types and facilities and the Danish topographic and climatic conditions are also less variable / far reaching as in some of the other countries covered in this study. It can be speculated, that this might be among the reasons why the specific restrictions imposed on Danish trout farmers are quite sophisticated. It is especially the level of detail in many different categories of operation and production (see below) that are directly addressed by the permitting authorities that make a difference to other producers in other countries.

With the 2012 change in fish farm law [26], most of the Danish farms (an exact number or proportion is not known to us) are now regulated mainly under their specific discharge regulation (synonym to discharge limit, outlet monitoring). Such a system, which is largely unknown to most of the other countries investigated in this study, forces both the farmer to document and reveal a lot of details about his production that he otherwise would not necessarily need to do. On the upside, this provides a basis for process optimisation and improved transparency, e.g. on resource consumption or actual discharge per product. This could be a potentially useful mechanism to promote marketing or certification of the products. It was beyond the scope of this study to look deeper in to this aspect. Similar notions were received from the United Kingdom interview partners (see United Kingdom section below). On the downside, this flood of information, technical details and necessity for assessment (on farm, in the adjacent environment, eventually along the whole river catchment area at worse) adds a hitherto unknown complexity to the fish farmers' profession. As mentioned by the interview partners, there exist a plethora of supportive structures (e.g. technical and environmental consults, experts from professional associations) which eagerly provide an excellent service to the fish farmers. But still, the question remains how this system will change the job profile of fish farmer in Denmark. Rooting in a traditional, craftsman job the Danish fish farmer in the future potentially has to become a multi-versatile data- and project-management expert. This diversification of the job portfolio and fields of competencies is not a negativism in itself, but it should not be assumed that this development will happen without side effects to the individuals and the sector.

Table 4 Questionnaire. DENMARK. Section 3.

3.1. Size	
a. Is there a production size limit for the permission (e.g. maximum production volume, feed usage, water usage, area)?	No, not in principle. Fish-farms/farmers now have the possibility to run the production based on Discharge Limit only. Controlling the amount of pollutants in the outlet-water by regular sampling and analysis. The sampling must be flow-correlated (samples in both inlet and outlet to be analysed). 26 samples/year. If you can prove that the effluent will be within the given(effluent) limits you can produce whatever quantity you want. That is, if you apply more cleaning technology you are allowed to produce more.
b. What is the maximum size of your production you are allowed to have?	No limits as long as the outlet is within the limits given. The limits will depend on the receiving water-body as they (the rivers) may have different order on environmental quality requirements for the specific aquatic areas.
c. Are there different requirements for different sizes of production (e.g. full EIA for a large farm, less detailed investigation for a small farm)?	No, the complexity of the permissions are due to the impact on the environment and location in relation to Natura 2000 sites, water resources etc. Of course, in most circumstances the impacts are related to the size of the fish farm.
d. What are the thresholds, if any?	-
e. In case, permissions are limited by production size, can you apply for more than one permission?	-
f. What are the conditions for doing so?	-
3.2. Facility type	
a. Are there different requirements for different facility types (e.g. earthen ponds, concrete ponds/raceways, indoor/outdoor, flow-through, partly-recirculated, located in country-side or in an industrial area)?	The overall rules are the same. But in the concrete cases the demands are different depending on technology, planning status for the area, etc.
b. Is there any kind of production facility that would be generally considered IMPOSSIBLE to get a permission for (e.g. see above)?	No, but in the last 20 years it has been almost impossible to get a permission for a new fish farm, unless it is a recirculated farm.
3.3. Water	
a. How much INTAKE water are you allowed to use?	N.A.
b. What OUTLET water composition do you have to fulfil?	It will differ from location to location as the receiving rivers will have different goals for water quality. 1: To stay within the limits for yearly discharge. 2: To stay within the daily limits. 3: Measurements/analysis shall document within a 95 % probability that the outlet water is not beyond the approved limits, stated in the Environmental licence.
c. Is there an ABSOLUTE (irrespective of production volume) limitation on the intake / outlet water QUANTITY (e.g. expressed as litre per second or percentage of a river flow)?	Yes. There always has to be ½ Q_{mm} (in Danish: Median-minimumvandføringer; in English: median minimum water level) in the river. [info on how to assess Q_{mm}: [38] reference added by the authors]
d. Is there a RELATIVE (in relation to production volume) limitation on intake / outlet water QUANTITY (e.g. volume per kg produced, volume per kg feed used)?	Yes, for some kind of production.
e. Are there ABSOLUTE requirements for the COMPOSITION of outlet water (e.g. maximum content of nitrogen, maximum suspended solids)?	Yes

f. Are there RELATIVE requirements for the COMPOSITION of outlet water (e.g. nitrogen discharge per kg produced)?	Nitrogen, phosphorus, BOD pr. kg fish produced and a maximum outlet related to the water flow in the recipient (max mg nitrogen / l)
g. Are there RELATIVE or ABSOLUTE requirements for the COMPOSITION of outlet water in relation to the flow (e.g. e.g. nitrogen discharge per liter outlet flow and/or related to concentration in the inlet flow – in other words: additive load per water volume)?	-
h. Is there a fee/cost for using/abstracting the water from the river/the well? If so, what are the cost/fee?	No
i. Is any or all of the above restrictions limiting the production on your site (e.g. when your river / well has more capacity than you actually are allowed to use)?	Even an allowance to extract more water will not, alone, be able to enhance the production as the limits are set on the amount of pollutants in the outlet. Only extra water cleaning equipment can enable an increased production. It is of outermost importance that the sampling is done in a homogeneous way – fluctuations of analysis result may cause problems, as it may be judged as problems keeping the effluents within the given limits. Even though amount of feed given to the fish and temperature will vary with season and standing stock, may cause variations! Within 95% significance-level it must be proven that the production is not offending the limits. But if we can clean and reuse the water more intensively we can produce more. If more water is available e.g. 90 l/s we will have to apply for a new/altered water-extraction-license – and this will probably also demand a review/renewal of the environmental approval as the water-license is a part of this approval
3.4. Sludge	
a. Is it mandatory to collect and remove sludge?	Yes, organic materials from fish-production (manure) is collected (above a certain size, determined by the filtration-system). As the dry-matter content is low, some farmers ad aluminium-chloride (AlCl) is added (organic matter and phosphorous is attached to AlCl) this mixture goes to a buffer-tank where a polymer is added and water is drained on a sieve-band. Water extracted from sieve-band is going back to bio-filters for cleaning and the sludge/concentrated manure is left to drain further before it is spread on agriculture areas. Other methods, as e.g. 'Geo-tube' are also used.
b. Is there an ABSOLUTE limitation on sludge quantity (e.g. tons of dry matter per year)?	No
c. Is there a RELATIVE limitation on sludge quantity (e.g. kg sludge per kg produced)?	No
d. What further usages of sludge are allowed (e.g. as fertilizer, biogas, composting, dumping)?	No further
e. Is your permission / license linked to a sludge quota (e.g. maximum allowable quantity per year)?	Analysis of sludge is mandatory and is a part of the 'fertilizer-balance account'. Fish-farmers must document this to be able to hand over the manure to agricultural farmers as they will have to count the fertilizer-value into their balance-account.

3.5. Feed	
a. Does your permission / license specify any limitation on the feed you use (e.g. brand, country of origin)?	Some permissions are based on feed quota, some on effluent-control [in relation to change in law [26]; see beginning of this section, reference added by authors]. All permissions have a limitation about feed composition. The Environmental licence will contain rules according to departmental order on animal feed [39]: Have maximum 1% P, maximum 9 % N and minimum net-energy of 4,35 Mcal/kg. Dust must not exceed 1%. On top of the feed quota will restrict the production and the following demand for the feed conversion rate (FCR): For fish > 1 kg – FCR maximum 1, for fish < 1 kg FCR must not exceed 0,95. The feed-companies normally will secure observance to this.
b. Is there any specified requirement for the feed components, composition (e.g. feed specific N-, P-content, N-, P-discharge, faecal stability, digestibility)?	Yes.
c. Is your permission / license linked to a feed quota (e.g. maximum allowable feed quantity per year)?	Feed quota / or outlet quota (min 26 outlet analyses a year)
3.6. Land / area usage	
a. Are you the owner of the land / area that you are using for production?	NA
b. If you are not the owner, which legal status / agreement do you have with the actual owner (e.g. a lease contract)?	If you lease the land the contract shall be for many years
c. How does this ownership-status affect your rights in relation to production permission / licensing?	You must own the land or have a long-time contract
d. Is there an ABSOLUTE (irrespective of production volume) limitation on the area usage (e.g. expressed as ha water surface area)?	Yes, nature status and/or nearby protected areas /habitats are restricting e.g. buildings After you have obtained an environmental approval, it is not allowed to add any building. If you need new/extra constructions/building you will have to request for a building licence/ planning permission. If you obtain this, it has to be added to the environmental licence.
e. Is there a RELATIVE (in relation to production volume) limitation on the area usage (e.g. water surface area per kg produced, area per kg feed used)?	Max. 50 kg fish/m^3 in average, but very often the density is higher – especially during winter when the fish rest and eat very little.
f. Do you have a requirement to work in different intensity levels on certain areas of your property (e.g. leaving one pond untouched as compensation area for producing in another pond)?	Yes, constructed wetland/lagoon is a must.
g. What are typical spatial planning conflicts with habitats, protected areas? Please give an example.	E.g. in case of protected area on the periphery of the farm, the local municipality has to assess if the fish-farm in any case could end up in a conflicting situation with 'habitat-areas' (e.g. Natura 2000, protected areas) in the vicinity. The assessment has to cover /consider 'habitats' down-stream (even the final receiving coastal area). This assessment is a part of the environmental licensing procedure. Authorities would 'love' to have the right to expropriate fish-farms located in or close to habitat/nature 2000/Ramsar or otherwise protected areas.
h. How close is/are your farm(s) located to a protected environment (e.g. Natura2000, etc.)?	NA

i. How does the site location affect the permission process (e.g. when located in or close to a Natura2000 site)? Please give an example.	More difficult to achieve permission if the farm is located in or close to a Natura 2000 site - the fish farm has to make a Habitat EIA (Habitat impact analysis). Most Danish farms was established before the area was classified as a habitat.
j. Are there any areas that are PRECLUDED from trout farming (i.e. where the government really wants to have no farms)?	No, but on the other hand there are no places were the government want any new trout farms. Although one municipality (Ringkøbing-Skjern Municipality) has made a special planning process with sites not attractive for trout farming and sites attractive for trout farming.
k. Are there any areas that are PRIVILEGED for trout farming (i.e. where the government preferably wants to have farms)?	See j
l. Does your fish farming permission / license regulate your property usage (e.g. in terms of percentage of land that must not be built on)?	NA
3.7. Predators and other wildlife	
a. What "general" measures are you ALWAYS allowed to use against fish-eating predators (birds, otters, etc.) (e.g. noise deflection)?	It is mandatory, due to veterinary issues, that all Danish fish-farms are equipped with birds-netting (covering the whole area of the farm - mostly to reduce the contamination risk from birds flying from farm to farm transporting pathogens). In some areas electric fences preventing (to some degree) otters to enter the farm – is a must – and allowed. Need special permission for using noise deflection. Traps and poison against rodents/rats
b. What "special" measures are you ONLY allowed to use against fish-eating predators (birds, otters, etc.) when you are in possession of a special license or in dedicated areas or times of the year (e.g. gun shooting only with hunters' license)?	If you have a high predatory pressure from herons and/or cormorants, you may apply for an exemption. You will need a game licence or you have to hire someone with a game licence.
c. What measures are you NOT allowed to use against fish-eating predators (birds, otters, etc.)?	No shooting without permission. No poison (apart from rodent combating – and only by authorised person)
d. Which of the above mentioned measures to use against fish-eating predators are most frequently used in your country?	Birds net and heron (cormorant) shooting
e. Is there any practical experience / scientific documentation or other source of evidence for the effectiveness of these measures in your country? Please provide source name and web-link if applicable.	No
f. What other "problematic" interactions with other types of wildlife (other animals, plants, etc.) do occur?	-
g. How are they "typically" regulated? Please provide reference and web-link, if applicable.	-

3.8. Energy	
a. Does your permission impose any requirements / regulations on your energy consumption (e.g. maximum kWh use or kWh per kg produce)?	There are no formal regulations or demands for maximum energy use per kg fish produced. Fish farming is getting more and more recirculated in Denmark, so the energy used per kg fish produced is increasing. Energy is in some way regulated by a BAT-demand (to use Best Available Technology) and this could encompass more energy-efficient equipment as fish farmers have to show that the most energy saving technology is used e.g. pumps, processing etc. Most farms are situated in or near habitat-areas - which will prohibit establishment of wind-turbines. In some places solar panels could probably be allowed – but for the moment being this energy-form is too expensive and to unstable in Denmark
b. Are there any requirements to maximum amount or demands on reduction of energy used – when OBTAINING a MAINTENANCE license (if this is applicable in your country)? (e.g. per kilo produce, percent reduction to comply with - or otherwise?)	See 3.8 a
c. Are there any requirements to maximum amount of energy used - when OBTAINING a NEW LICENSE? (e.g. per kilo produce or otherwise?)	See 3.8 a
d. Does your farm have a connection to the public electricity grid or do you use other means to generate electricity? Please specify (e.g. Diesel generator, solar panels, proportion of renewable energy).	All farms have power-access from the grid. Some farms (Semi-RAS/Model-farms) have auxiliary power supply (diesel generators).
e. Does your permission create any incentives / benefits to safe energy in production or to use renewable energy sources e.g. windmill, solar (Renewable energy sources is a must in organic production)	-- Organic farms must use 'green' electricity.
3.9. Interactions with other stakeholders	
a. What are "typical" regulations that affect your interaction with other stakeholders, like: (Please give examples and references, if applicable)	All permission has to go through a public 4 week hearing period.
○ Recreational anglers	Recreational angler are very active opponents to aquaculture.
○ Migrating fish organizations, conservation organizations	-
○ Environmental NGOs	Active
○ Tourists and tourism industry	-
○ Agriculture, farmers	-
○ Water energy, power dam operators	-
○ Others (please specify)	-
3.10 Veterinary and animal welfare affairs	
a. How frequently are you interacting with your veterinarian?	Public veterinary controls twice a year. They will mainly take samples of fish/from fish to control for remains of antibiotics. Local veterinary – only when needed. We have had no need to use antibiotics during the last two years. Through more than 10 years (as long as the farm has been productive) we have only been forced to use antibiotics 5 times! As we are using well-water no diseases from the natural river-water will enter the farm!

b. What are the most common reasons for you to work with a veterinarian?	Prophylactic and for reporting the annual consumption of prescribed medicines PKD (proliferative kidney disease), treatments for parasites. Veterinarian to approve our own diagnosis and/or recommend treatment.
c. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Medicines and auxiliary chemicals and the use of these are described/included in the environmental licence. There will be clear/well-described limits ensuring that the receiving water-body/river will not be harmed. This includes rules for keeping the treated water for a certain time within the farm. Concentration of treatment substances allowed to be discharged will be pinpointed in the environmental licence.
d. What kind of veterinary approval is required to obtain the permission?	Depending on the farms risk of getting and spreading diseases the Danish Veterinary and Food Administration decides how often the farms shall be inspected (some farms twice a year others one every second year). If the farm does not fulfil the legislation the Authorities can shut down the farm.
3.11. Medicines & chemicals	
a. Are medicines only available after veterinary inspection and prescription?	Yes, and only if the fish farm has a license to use the medicine in the environment permission according to the rules of the Water Frame Directive.
b. Are you allowed to store veterinary prescribed medicines at your farm?	Yes, very limited amounts prescribed medicines can be stored (for usage) on the farm for up to 10 days, in locked-up cupboard or similar. Type and amount must be registered in the logbook. Excess medicines have to be returned to the veterinarian/ pharmacy.
c. If yes to b: Under which conditions are you allowed to store medicines – and in which amount?	Antibiotics normally for 10 days. If you have an approved agreement of regularly health inspections with a veterinarian, you can store the antibiotic for 35 days. Vaccines, anaesthetics and antiparasitics you can store until the expiry date of the product. The veterinarian registers all medicines used on every farm for the year. Veterinarian will report to the authorities at the municipality.
d. Is it mandatory to register the medicines in storage?	Yes, it is a standard – scheme signed by vet. Describing how to use – farmer has to note on the backside of scheme on the use.
e. Are you allowed to apply the stored medicines at your own or only under veterinary instruction?	Yes, both.
f. Is it mandatory to register the use of chemicals and medicines? If yes: How do you register?	Yes. It is mandatory to register all use of medicine and chemicals in the daily management journal.
g. What kind of medicines & chemicals are you allowed to use (e.g. formalin/ formaldehyde, salt, hydrogen peroxide)?	In Denmark a list of 'veterinarian approved medicines and auxiliary chemical' will be a part of the environmental licence. The fish farmers can use following antibiotics: sulfadiazin/trimethoprim, oxylinic acid and florofenicol (if allowed in the environmental permission). Further they can use a longer list of vaccines and anaesthetics. Chemicals: Most used: Copper, formalin, sodium chloride, Chloramine-T, hydrogen peroxide, per acetic acid (if allowed in the environmental permission), quick lime.

h. What kind of medicines & chemicals are you NOT allowed to use that you historically did use (e.g. malachite green)?	The fish farmers are allowed to use the medicines and biocides that are accepted according to the veterinary and biocide legislation. But only if the farmers also have a permit from the environmental authorities according to the Water Frame Directive.
i. Which of these substances do you use regularly to treat your fish?	Depends on what you mean with regularly. Some substances are used a few times a year. Others every week. Formaldehyde, Hydrogen peroxide, Peracetic acid
j. Please list the medication you normally use (based on a veterinary prescription).	See g
k. Do you use vaccinated fish in your production?	In most farms in Denmark vaccination is mandatory, unless the veterinarian argues that vaccination is not a good idea for the specific fish farm.
l. Do you vaccinate yourself or do you buy already vaccinated stocking material?	Both.
m. Which of these substances do you use regularly for other purposes (e.g. disinfection between production cycles, disinfection of equipment)?	Regularly only chemicals - Formaldehyde, Hydrogen peroxide, Per acetic acid.
n. What are relevant limitations for the use of these substances (e.g. maximum allowable use of a disinfectant per production/per water-volume/per kg-fish)?	The limitation for use are depending on stock, and concentration in the outlet. This is depending on the recipient and dilution and decomposing before the treated water reaches the river
o. What special regulation exists for effluent water containing residuals from medicinal or chemical treatment (e.g. maximum residual concentration)?	Maximum residual concentration depending on the recipient and potential other users. According to the rules of the Water Frame Directive and Danish regulations. Many farmers recalculate (backwards) and uses the allowances stated in the environmental licence. Retention time allowed concentrations, decomposition (bio-filters) and dilution. No direct measurements/sampling in outlet.

6.1.1.3 SELF-MONITORING AND REPORTING REQUIREMENTS ON FARMS

Self-monitoring in Denmark

An environmental approval must contain conditions for self-monitoring and should include the following:

- Measurements, sampling, analysis and reporting, including where, how often and within which periods
- Procedures for the maintenance and inspection of the farm, including its purification systems
- Organization of the self-monitoring, including responsibility for the individual parts of the verification

It shall be noted, that the rules of self-monitoring merely are minimum requirements. The municipality issuing the environmental approval must always consider the needs for additional self-monitoring issues.

For fish-farms regulated on discard-control [after change in regulation [26]]

The fish-farmer must, in accordance with the statutory order take measures to take 26 annual samples of water from both inlet and outlet. If analysis-results are stable, and the farm is using water from a borehole, the number of samples can be reduced to 12.

Control of maximum daily discharge is assessed on the basis of the level of current control period of approximately 14 days (26 samples annually) as well as the continuous measurement of water in/out.

For total N (TN) and total P (TP), where maximum discharge is controlled on maximum derived quantities to be observed as a running average over a week, it will be most appropriate for the controlling municipality to calculate a daily release based on a running average over 7 days.

24-hour water they find from the continuous measurement of the water out, and 24-hour concentrations of TN and TP are obtained by linear interpolation between the 14-day 24-hour concentration measurements, then you have a 24-hour water and 24-hour concentration are multiplied together to the net 24-derived substance quantities.

For Ammonium-N and BOD, only concentrations are available to use for calculations. Linear interpolation is applied to get a time series of net output concentrations, as the claim is to stay under the limit – that is no 24-hour remedy but the momentary situation.

If 24-hour concentration is near the limit and there have been variations in the measured water flow, it is to be judged over the limit. Between sampling days, the controlling municipality may examine the water flow curve, to judge if there may have been some pulse in discharges.

BAT requirements should be assessed on the basis of measurements on an annual basis in relation to the annual production.

For measurements on fish farms on the feed quota [after change in regulation [26]]

In accordance with the statutory order, fish-farmers has to take 12 samples – 1 every month from the total discharge water as well as on water intake within an operating period of 1 year. BAT requirements should be assessed on the basis of measurements on an annual basis in relation to the annual production.

Table 5 Questionnaire. DENMARK. Section 5.

5.1. Environmental self-monitoring	
a. What information (in relation to the above mentioned restrictions) do you routinely monitor and document yourself as a farmer? Please indicate these metrics here, unless you haven't already done so in the beginning of the questionnaire (see 1.)	Water samples, 26 times/year. Sampled by independent third party (analysis-company). Samples must be flow-correlated both in inlet and outlet. Daily logbook: Everything must be registered; amount and type of feed used; dead fish (numbers and weight); movement of fish from pond to pond; harvest and sale of fish; purchasing (eggs, fry, fingerlings, materials); diseases; treatments (medicines/chemicals); all craftsmanship done through the day is also registered – everything by computer-program. So we have traceability through the whole production.
○ Production size, i.e. quantity of fish produced	See a
○ Use of different facilities (e.g. ponds or raceways)	See a
○ Water (i.e. quantity and quality parameters)	See a
○ Sludge	See a
○ Feed	See a
○ Land / area usage (additional to facility)	See a
○ Energy	See a
○ Medicines, chemicals	See a
b. How do you monitor and document (writing/filling out tables/formulas in paper, electronically using software on a computer)?	See a
c. Are there regulations that specify how to do the self-monitoring?	All stated in the environmental licence.
d. Is there specific equipment required to monitor (e.g. special types of probes to be used for water quality)?	Oxygen must be measured. Water-flow, in and out of the farm must be monitored. For both parameters the inaccuracy of equipment shall be less than 5%.
e. When, how and by whom are your self-monitoring documents checked?	Checked by persons from the municipality (or hired by the municipality) 1-2 times a year

f. How long do you need to store them?	5 years
g. Can you provide us with a (blank) copy of your self-monitoring documents as an example?	Electronic only
h. What happen if your self-control measures are out of bounce/beyond the limits of your license?	When we find something over the limit we are forced to report it to the log. Also prevention measures shall be recorded – followed by a description of the time-horizon for the values to be within limits again.
i. What are the consequences….?	Description and explanation in log. I can risk having a written critic/ protest and a limited time to correct the fault. In severe cases a fine can be issued. Depending on the fault – doing my best to correct e.g. repair equipment, change normal procedures
5.2. Environmental controls	
a. Who conducts environmental controls (e.g. authority, delegated institution or the farmer himself)?	The municipality will send a biologist or other 'expert' to examine the fauna-index up- and downstream (or they may hire a consultant to do the job). Water-samples on inlet and outlet water, 12 - 26 samples/year, are done by an independent third party, which will also do the analysis. Results are sent to the municipality and in parallel to the fish-farmer. The fish farmers pay for the control.
b. How frequently are you controlled?	Every year on farm and every year invertebrate in the recipient. 12-26 times water analyses.
c. Are the controls announced or spontaneous?	Farm visit can be both. If the authorities want to see the management protocol or other written documentation, the visit will be announced two weeks before. Fauna analyses and water Invertebrate is spontaneous.
d. What kind of documentation is required?	Result s from analysis is sent in parallel to fish-farmer and municipality
e. What does the controlled check (e.g. environmental index in the receiving water-body (flora & fauna indexes), other types of measuring possible impacts)?	The authorities conduct environmental visit on the farm and fauna analyses in the recipient. An independent analyses institute take samples up to 26 times a year on inlet and outlet water.

6.1.1.4 PERFORMANCE OF PERMISSION

The eight years' validity of the environmental approval is a key aspect to the permission performance. The fish farmer might, for whatever reason, undergo processes of consolidation or change in its business development. Any of those changes, might it be the intend to invest into new farm technology or hiring of new staff or simply the wish to get a loan for private purposes, needs to be synchronised with this eight years' periodicity.

Table 6 Questionnaire. DENMARK. Section 6.

6.1. Your experience with permission	
a. Did you ever have to apply for a license to MAINTAIN, OBTAIN NEW or OBTAIN EXPANSION license?	Yes, environmental approval is valid for 8 years hereafter you will have to apply for renewal. If you want to change your production you can always send in application for renewal. New fish-farms and fish-farms to be fully modernised (e.g. to semi-RAS/model farm) must apply and have approval before construction begins.
b. How long did it take in your case to get the license?	½ till 10 year depending on any appeals from civil society.
c. What negative experiences did you make?	Waste of money and time
d. What positive experiences did you make?	Improved financial possibilities (easier to take a loan

	as there is 8 years of 'peace') Improved sales-price.
6.2. In your country in general	
a. How many NEW production licenses have been granted in the last 1, 5, 10 years?	No new licenses for fresh water trout fish farms. A few fully recirculated (RAS) indoor facilities FREA (indoor)
b. How many existing production licenses have been CHANGED in the last 1, 5, 10 years?	Many
c. In how many cases was the production volume increased?	Many – due to implementation of technology.
d. What was the success rate of applications in the last 1, 5, 10 years?	40-50 changed

6.1.2 GERMANY

The Federal Ministry of Food and Agriculture (Bundesministerium für Ernährung und Landwirtschaft – BMEL) is the highest competent authority for aquaculture in Germany. It is the main contact point for the EC and other member states and handles the correspondence for some of the EU laws which are not directly regulated by the federal states (e.g. alien species regulation 708/2007). The BMEL holds annual informal and formal meetings with the respective competent authorities of the federal states.

There are 16 federal states in Germany, of which each has its own main competent authority dealing with aquaculture. They are in most cases affiliated with the federal state ministries of agriculture and/or environment of the federal state. The working group of the fisheries delegates holds regular meetings and is headed by one of the federal state delegates throughout one year. The federal states and the federal level maintain a common website for all fisheries and aquaculture affairs, which also lists all relevant contact details (http://www.portal-fischerei.de/ ; in German language only).

None of this authorities on federal and federal state level is directly involved in the permission process to apply for a new fish farm approval. Only the federal state authorities are formally recognized as the supervising authority ("Fachbehörde") for some aspects of environmental and fisheries law. The application and permission process is handled exclusively by the next lower level of administrative organisation. On federal state level, there are several subdivisions in place[1]. Most relevant in terms of aquaculture regulation is the level of administrative districts ("Kreis"), of which there are 402 in total. They have the most direct competence in water, environmental and veterinary regulation. Below the districts there are municipalities ("Gemeinde") and cities, of which there are 12,141 in total. Their competence is mainly in building law, which typically is the main carrying vehicle for seeking permission to open a new farm. This dissociation across the administrative levels is cause for much of the concern expressed by the interview partners, but it has to be noted that this is a fundamental, structural characteristic of the German administration which affects many other areas as well ("Föderalismus").

6.1.2.1 OBTAINING PERMISSION / LICENSE FOR TROUT PRODUCTION

Water use and discharge is regulated under the Federal Water Act (Wasserhaushaltsgesetz – WHG, last amended in 2009, [23]). It regulates water resource management measures (management of water quantity and quality) and is applicable to all types of water use, including agriculture and industry, but not specifically pertaining to aquaculture. Typically, the traditional trout production in flow-through systems is not considered a use of water, because it does not involve excessive pumping or damming of water and the free flow of the water is not significantly hindered. This aspect is key to the status-quo of water use for many German trout producers.

Each federal state has its own water law and several related laws and regulations pertaining to the eligible access to and use of water as well as the costs related to it. These laws can have fundamental differences in what is considered "extensive" or "intense" aquaculture and if a permission or even an EIA is necessary. By German EIA-law [40] not all fish farm operations require EIA. The EIA-law definition (see Annex 1 of the law [40]) of qualifies as: i) 1000 tons annual production: require a full-spread EIA; ii) 100 – 1000 tons annual production: require a general pre-assessment (allgemeine Vorprüfung des Einzelfalls: siehe § 3c Satz 1); iii) 50 – 100 tons annual production: require site specific pre-assessment (standortbezogene Vorprüfung des Einzelfalls: siehe § 3c Satz 2).

The lower water authorities (on district level) have the competence to decide on the eligibility of water use permission. The water use permit can specify limitations on water flow, self-monitoring, discharge values and requirement for the use of water treatment technology.

Typically, the lower authorities refer to the higher authority (on federal state level, affiliated with a ministry or a delegated institution) to get advice on BAT/BEP. That is the reason why most of the German BAT/BEP is published by (or in co-authorship with) these institutions. For the trout sector, especially the federal states Bavaria [41] and Baden-Württemberg [42] and various cooperative groups of those states and institutions [43] have published such documents that are also frequently used by other federal state authorities.

[1] https://en.wikipedia.org/wiki/States_of_Germany#Subdivisions

The water use permission can be valid from a few years to perpetual, depending on the federal state and the point in time when the permission was granted.

The federal law on environmental protection [44] has only very limited direct implications for trout production, but many of the federal environmental protection state laws and other law areas (e.g. fisheries law) reference to the general impetus of this law. This pertains i.a. to the maintenance of biodiversity and the role of water management (e.g. in ponds) for maintaining stable habitats.

Building law is regulated on national level by the building law (Baugesetzbuch, [45]). It is accomplished by federal state specific building laws and regulations. When building a new land-based fish farm involving construction work (e.g. for raceways, technical buildings, etc.), the building application process is typically the carrying vehicle for all other legal frameworks and permission. It falls under the responsibility of the building authority of the districts to collect the qualified statements from environmental protection and water use and to combine all required documentation and application paper work. Typically, this happens as a building pre-application ("Bauvoranfrage" or "Bauvorbescheid") which shall cover all critical questions for the general eligibility of the building project. This pre-application is a lot less cost intense than a full building application and it usually has to processed (brought to a decision) within three months. Each federal state has its individual laws, specifying the actual scope and legal character of the pre-application. Some types of building can be built free of a building permission, e.g. when they are not exceeding a certain square-meter area and when they are closely linked to the operation of the farm. This is specified in the federal state laws.

Building of a trout farm in Germany can be considered a privileged building activity under certain conditions, which is especially relevant when building on a property where there is no land development plan ("Bebauungsplan") in place. This type of permission is typically used for agriculture buildings (e.g. staples) far away from the next settlement. The eligibility for privileged building is dependent on some general statements of the sustainability and relevance of the business. Because federal states have different practices on the consideration of privileged building, it has become a bit of a political subject as well. Bavaria and Baden-Württemberg would typically acknowledge the privileged building of a flow-through or part-recirculation trout farm, because the traditional types of aquaculture (falling under the logic of inland fisheries and pond production, "Binnenfischerei und Teichwirtschaft") has the same status as agriculture. In other federal states, the regulations are much stricter and aquaculture is generally not considered a privileged building activity, unless it is realized on a very extensive production level and without the use of concrete-buildings or other technical installations. Some of our interview partner expressed their concern about this, because it makes it much more difficult for them to change their farm structure. Especially when they are located in the outside area, i.e. beyond land development plans, they are refused the permission to build new facilities, because those should be built in a planned area (typically a business park near the next settlement area). This means, they cannot break down an old concrete raceway and replace it with round-tanks and a biofilter, not even mentioning an insulated building for a RAS.

Each producer needs to be registered or permitted under EC directive 2006/88 on animal health. This directive is implemented in German law on national level (Fischseuchenverordnung, [46]). Even small, non-commercial producers fall under this law. Each permitted producer is listed with a 12-digit producer number.

An animal keeping permission in line with animal protection law [47] is required by each producer. A proof for qualification is needed to be eligible for such a permission. Typically, this qualification is sufficiently granted with a professional job training ("Fischwirt") or a proof of sufficient work experience. Other less formalized degrees of qualification ("Sachkunde") can be negotiated with the authorities. Some public institutions offer training courses for this purpose.

In Germany, there is no specific law pertaining to the permission to operate a fish farm, but each professional producer needs be registered as a food producer. This is realized by the food security authority of the districts.

The federal state of Schleswig-Holstein has published a conclusive document describing all related law texts [48] (in German language only) pertaining to seeking approval for a new farm operation. It lists the following permits that an investor has to seek for a land-based alas inland aquaculture/fisheries production (the terminologies of aquaculture and inland fisheries are not strictly separated in the German administrative language):

- Building permit
- Water use permit

- Environmental permit, potentially including EIA
- Fisheries permit
- Veterinary permit
- Feed and food authority permit
- Animal welfare permit

The German interview partners highlighted the relevance of competent staff at the public authorities involved in licensing and permission processes. As outlined above, mostly the lowest regional / communal authority has far reaching competencies on building law, water law, environmental law, animal keeping and other aspects. Some of the partners noted that they are the only fish farm in the region under control by the respective authority. Hence, the staff at the authority office has no regular experience with fish farms and will try to relate/compare it to other cases. This has led to cases where individual staff members of the local authority came up with requirements that were not only meaningless to the viable operation of the fish farm but also not in line with current law.

Table 7 Questionnaire. GERMANY. Section 2.

2.1. Type of permission	FLOW THROUGH	SEMI-RAS
a. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Water-rights-note with time limit ("Wasserrechtsbescheid") Licensing needs district authority („Kreisverwaltungsbehörde") with the lower authorities (Untere Behörde): Water, Nature, Construction, Veterinary, and agricultural office ("Landwirtschaftsamt") for the company number; fisheries consultancies ("Fischereifachberatung") of the districts Selling of fish for restocking purposes: obligations from the veterinaries before sale. Transportation permission it you transport fish yourself. Bigger farms are reviewed every 20-30 years in regard to new obligations. Water analysis 4 times per year for intensive farms and 2 times per year for extensive farms	Water-rights-note with time limit ("Wasserrechtsbescheid") Licensing needs district authority („Kreisverwaltungsbehörde") with the lower authorities (Untere Behörde): Water, Nature, Construction, Veterinary, and agricultural office ("Landwirtschaftsamt") for the company number; fisheries consultancies ("Fischereifachberatung") of the districts Selling of fish for restocking purposes: obligations from the veterinaries before sale. Transportation permission it you transport fish yourself. Bigger farms are reviewed every 20-30 years in regard to new obligations. Water analysis 4 times per year for intensive farms and 2 times per year for extensive farms
b. What permission(s) is/are needed to OBTAIN the license for EXPANSION of an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).		
c. What permission(s) is/are needed to OBTAIN the license to establish a NEW trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).		
d. Who can apply for such a permission (e.g. farm owner, producer association)?	No qualification needed.	No qualification needed.

e. What qualification is needed to apply (e.g. work experience as farmer, relevant degree or diploma)?		No qualification needed Exception: outdoor constructions require further vocational training; possibly EMFF Requirements
f. How long is a permission valid?	Many old licenses without time limit, earlier ones got 20 years at first- and then 30 years - thus still valid. Some has amendments due to expansion of farm and/or new facilities. Today possibly 30 years	In principle 30 years Almost no new farm constructions; almost no chance to get new permissions.
g. How frequently do you have to re-apply?	Some permissions need to be renewed on a regular basis: Transportation every 5 years Cat. 1: yearly Water rights: every 12 years Water discharge permission: every 12 years	Some permissions need to be renewed on a regular basis: Transportation every 5 years Cat. 1: yearly Water rights: every 12 years Water discharge permission: every 12 years
h. Is there a difference between "old" licenses and new licenses (e.g. license stemming from before 1992, Foundation of EU)?	No licence-based system. Depending on intensity levels as defined by [41]. Increasing obligations with increasing level. Annual feed burden per litre per second per year (specified in the document "Teichbauempfehlung" from Bavarian water authority [41]): Level I (low): <150 kg feed per l/s Level II (medium): <500 kg feed per l/s Level III (high): >500 kg feed per l/s	No licence-based system. Depending on intensity levels as defined by [41]. Increasing obligations with increasing level. Annual feed burden per litre per second per year (specified in the document "Teichbauempfehlung" from Bavarian water authority [41]): Level I (low): <150 kg feed per l/s Level II (medium): <500 kg feed per l/s Level III (high): >500 kg feed per l/s
i. If there are such "old" licenses, what are the main practical differences to new licenses?	Non-compliance permit ("Bestandsschutz") for old farms, even without water-rights-note Permission and Registration according to the fish disease regulation („Fischseuchenverordnung") 3000 trout farms in Bavaria	Non-compliance permit ("Bestandsschutz") for old farms, even without water-rights-note Permission and Registration according to the fish disease regulation („Fischseuchenverordnung") 3000 trout farms in Bavaria
j. What kind of permission do you have for your farm?	Licenced fish disease free farm (Cat. 1 farm); Water rights permit Discharge licence Fish transportation Direct marketing (slaughter, processing)	Groundwater usage, waste water outflow permission, EU permission, … 2000 – 2007
2.2. Legal framework		
a. Which laws (laws/departmental orders/ statutory instruments/directives/guidance and/or other forms of public regulations) are applied to regulate the permission process (see 2.1)?	Some authorities are more strict about Bavarian BAT's [41] than others; e.g. with already eutrophic or sensitive waters Water Framework Directive Flowing waters directive ("Oberflächenwasserverordnung"); based on the EU WFD 2000/60/EG	-

b. On which regional level(s) are these laws effective (e.g. whole country, state, region, municipality)?	Lower water authority; lower nature conservation authority Approx. 15 water management offices („Wasserwirtschaftsamt“) for several administrative districts („Landkreise“) In Bavaria: 7 counties (“Bezirke”), 52 administrative districts	-
c. How frequently are the relevant laws changed?	-	-
d. When was the last major / relevant change in the laws, concerning aquaculture, that you can remember?	-	-
e. Was this change directly related to an election or a new political party taking over the government?	-	-
f. What was the motivation for this change in the laws?	-	-
g. What was your opinion on the necessity / meaningfulness of this change?	-	-
2.3. Permitting authority		
a. Where do you have to apply? Please give full affiliation of the MAIN permission granting authority and link to website (if applicable).	Veterinary inspection office District offices Food and Consumer Product Safety Authority Ministry of Agriculture Municipal administration Hunting authority Building authority Separate applications for all licences and permissions at the different authorities; planning offices are expensive.	Veterinary inspection office District offices Food and Consumer Product Safety Authority Ministry of Agriculture Municipal administration Hunting authority Building authority Separate applications for all licences and permissions at the different authorities; planning offices are expensive.
b. Please indicate the geographic coverage of the authority’s responsibility (e.g. for the whole country, federal state, county, municipality, city).	Mostly district level some federal state level	Mostly district level some federal state level
c. Which further authorities are involved in the process? Please give affiliations.	Federal state fisheries research institutions (e.g. Bavaria, Baden-Württemberg, Saxony) Federal state chamber of agriculture (e.g. Lower Saxony, Schleswig-Holstein) Regional fisheries consultancy (Bavaria only) other Regional advisories (e.g. for Cormorants, Beavers)	Federal state fisheries research institutions (e.g. Bavaria, Baden-Württemberg, Saxony) Federal state chamber of agriculture (e.g. Lower Saxony, Schleswig-Holstein) Regional fisheries consultancy (Bavaria only) other Regional advisories (e.g. for Cormorants, Beavers)
d. Is there any mandatory third party involvement in the application process (e.g. research institutes, state agencies, third party experts; e.g. for statements, review of application)?	None mandatory only as consultancy to prepare documentation for building application	None mandatory only as consultancy to prepare documentation for building application

2.4. Application process to achieve production permit		
a. Is there more than one application necessary to MAINTAIN a license?	yes	yes
b. Is there more than one application necessary to OBTAIN a NEW license?	-	-
c. Is there more than one application necessary to OBTAIN an EXPANSION of an existing license?	-	-
d. Can you draw a (generic) flow-diagram for the license process, beginning with the preparation of the application until the final decision, including all parties involved and the main milestones(see example in Appendix page 180)?	Preliminary building application at municipality („Gemeinde“) and Building authority Difficult for outdoors Part-RAS with river outflow are privileged Complete-RAS with well water not, because they could be built in an industrial park as well	Preliminary building application at municipality („Gemeinde“) and Building authority Difficult for outdoors Part-RAS with river outflow are privileged Complete-RAS with well water not, because they could be built in an industrial park as well
e. Are there templates or guidelines available for the application? Please provide reference / source.	No blank forms; written applications – only form for EU-licencing (very complex!)	-
f. In which language can you / do you have to apply?	German	German
g. How much does the application cost (e.g. administrative fee for obtaining the license)?	Several 1000€; e.g. Transportation permission 80€ Veterinary monitoring: 800€ (2015)	Ca. 100.000€ estimated total cost including consultancy and assessments
h. Is there a fee for the license as such (e.g. fee per production volume/area, etc.; apart from any administrative cost)?	no	no
i. What is the official expected time to process the application (until decision – weeks? months? Or years?)?	-	-
j. How long does it actually take to get a license (e.g. based on the average of the last application process you know)?	Relatively quick; 4-8 weeks	1 – 2 years
k. What are the main causes for delays in the process (e.g. expert & public hearings, appeals, environmental impact assessments (EIA), law suits, etc.)?	-	Since 2014 mainly the lack of EMFF funding
l. Is there a legally binding maximum time the authorities can work on the application before giving a decision?	Building pre-application: 3 months	Building pre-application: 3 months

m. What documentation is needed for the application (e.g. map, GPS-location, description of facility, technical sketches, technical leaflets)? (See also questions to the use of specific technologies in section 2 and 3, below)	Drawings Description of watercourses Operating license	Site plan, building application with construction drawing, static, compensatory measures, calculated nutrient efflux, geological assessment for water usage, environmental assessment, etc.
n. If there is more than one application involved in the process, how do the applications interact?	Building application is vehicle for water and environment fisheries, veterinary, health/food, are dissociated	Building application is vehicle for water and environment fisheries, veterinary, health/food, are dissociated
o. Is there one application that is superior to the others?	Building (with water and environment) is typically concluded first, but this can be decided by the district authority	Building (with water and environment) is typically concluded first, but this can be decided by the district authority
p. Are the application processes completely separated from each other?	no	no
q. How do the different authorities interact with each other (e.g. based on a formalized procedure)?	Typically, the building authority (district level) calls a round table meeting with all (!) potentially involved parties as part of the pre-application. The outcome of this meeting decides on the scope and complexity of the pre-application. Only critically relevant topics (knock-out criteria, general eligibility of the project) should be dealt with there.	Typically, the building authority (district level) calls a round table meeting with all (!) potentially involved parties as part of the pre-application. The outcome of this meeting decides on the scope and complexity of the pre-application. Only critically relevant topics (knock-out criteria, general eligibility of the project) should be dealt with there.
r. What happens if one application is rejected?	pre-application: the whole application fails. full-spread building application: no reason for rejection should arise. Topics already in the pre-application, cannot be touched upon again in the main application	pre-application: the whole application fails. full-spread building application: no reason for rejection should arise. Topics already in the pre-application, cannot be touched upon again in the main application
s. What kind of written “proof” (e.g. verdict, official letter, certificate) do you receive in the end?	Each authority sends a separate licence/authorisation/permission e.g. water permit ("Wasserrechtsbescheid")	Each authority sends a separate licence/authorisation/permission e.g. water permit ("Wasserrechtsbescheid")
t. What is easier? Apply for a renewal of an existing license or apply for a completely new license?	-	-
u. What kind of application process did you have to go through?	NA	NA
v. Can you give us a copy of this document for your farm? (permit/license to produce and/or water abstraction permit/license).	NA	NA

w. What are the possibilities to complain or appeal a decision of refusal?	Always possibility for protest; chances of success are generally very low; depending on the authority protest can also be made judicial;	appeal
x. Does the fish farmer have to appeal himself or will the farmer's organization do it/assist the farmer?	himself	himself
y. Will an appeal be dealt with by public authorities directly or will it be necessary to start private proceedings?	-	-
z. Can the expenses for an appeal be estimated?	-	-
aa. What is he expected time span for the appeal to be accomplished?	-	-

6.1.2.2 RELEVANT RESTRICTIONS IN RELATION TO PERMISSION / LICENSE

The German legal system mainly imposes restrictions on the water quantity that can be used for production, which is also reflected by the fact the water authorities play a key role in defining rather simplistic BAT (see other chapter of this report). With increasing production size and increasing complexity of the facilities (in case of some interview partners), specified limitations on the water composition (discharge) were added. It is important to understand though, that the driving force for the increase in size and especially technical complexity was in most cases driven by the tightening of legal restrictions and not by the farm operator's intention. In combination with perpetual validity of the water use permits in some cases (see above and following section, depending on application year and federal state) this has led to severe limitations on the allowable (nutrient, BOD) discharge levels, which then in turn has stipulated the introduction of effluent water treatment and part-recirculation.

Table 8 Questionnaire. GERMANY. Section 3.

3.1. Size	FLOW THROUGH	SEMI-RAS
a. Is there a production size limit for the permission (e.g. maximum production volume, feed usage, water usage, area)?	In most federal states not directly regulated Stocking density is approved depending on the allowed amount of water usage: i.e. maximum 70t per 1000l/sec water	In most federal states not directly regulated No, only the nutrient load of the water outflow is limited
b. What is the maximum size of your production you are allowed to have?	In most federal states not directly regulated	In most federal states not directly regulated
c. Are there different requirements for different sizes of production (e.g. full EIA for a large farm, less detailed investigation for a small farm)?	d. Depending on federal and federal state EIA laws e.g. full EIA for >1000 to/a	Depending on federal and federal state EIA laws e.g. full EIA for >1000 to/a
e. What are the thresholds, if any?	-	-
f. In case, permissions are limited by production size, can you apply for more than one permission?	-	-

g. What are the conditions for doing so?	-	-
3.2. Facility type		
a. Are there different requirements for different facility types (e.g. earthen ponds, concrete ponds/raceways, indoor/outdoor, flow-through, partly-recirculated, located in country-side or in an industrial area)?	-	-
b. Is there any kind of production facility that would be generally considered IMPOSSIBLE to get a permission for (e.g. see above)?	-	Hybridisation of arctic char (alien species regulation) Application for Coho salmon, but denied due to risk of escaping Net cages in lakes are not possible; not by law, but environmental agencies are strictly against
3.3. Water		
a. How much INTAKE water are you allowed to use?	NA	NA
b. What OUTLET water composition do you have to fulfil?	Depends on intensity level and water permit	Depends on the water permit
c. Is there an ABSOLUTE (irrespective of production volume) limitation on the intake / outlet water QUANTITY (e.g. expressed as litre per second or percentage of a river flow)?	-	based on the production intensity
d. Is there a RELATIVE (in relation to production volume) limitation on intake / outlet water QUANTITY (e.g. volume per kg produced, volume per kg feed used)?	-	-
e. Are there ABSOLUTE requirements for the COMPOSITION of outlet water (e.g. maximum content of nitrogen, maximum suspended solids)?	-	-
f. Are there RELATIVE requirements for the COMPOSITION of outlet water (e.g. nitrogen discharge per kg produced)?	-	BOD (5d) and suspended particles are limited N and P are not limited, but water authorities are allowed to set N and P limitations
g. Are there RELATIVE or ABSOLUTE requirements for the COMPOSITION of outlet water in relation to the flow (e.g. e.g. nitrogen discharge per liter outlet flow and/or related to concentration in the inlet flow – in other words: additive load per water volume)?	-	-

h. Is there a fee/cost for using/abstracting the water from the river/the well? If so, what are the cost/fee?	No yearly fee for water usage, neither abstraction nor discharge, because of non-consumptive use of water (water is just borrowed from the river)	Historically water usage is free of charge a fee for pumping water ("Wasserpfennig") (around 3 cent/m³) is charged in some federal states but some regional authorities threaten to charge for water discharge ("Abwasserabgabegebühr") on the same level as for any industrial discharge fish farms located in industrial area are usually obliged to be connected to sewage water system and hence have to pay the full fee (effectively around 2 €/m³, depending on the price model of the communal water treatment) [49]
i. Is any or all of the above restrictions limiting the production on your site (e.g. when your river / well has more capacity than you actually are allowed to use)?	Full usage	Full usage
3.4. Sludge		
a. Is it mandatory to collect and remove sludge?	No, but the farms are collecting sludge; Farms have collecting ponds, which are emptied once a year and the sludge is then spread on the farm's own land for drying and generating soil; farm is also the sediment trap of the river sludge!	No, but Sludge is collected distributed on Agricultural land
b. Is there an ABSOLUTE limitation on sludge quantity (e.g. tons of dry matter per year)?	No New regulations would make the fish farm impossible to operate: there is too much particles and foliage in the river due to the barrages; if the farm would have to filter these out to reach the thresholds of clean water downstream of the farm, they would have to pay an immense amount of money for disposal.	No information in the licence
c. Is there a RELATIVE limitation on sludge quantity (e.g. kg sludge per kg produced)?	-	-

d. What further usages of sludge are allowed (e.g. as fertilizer, biogas, composting, dumping)?	Spreading on agricultural land, but needs to be recorded in regard to German "Düngeverordnung" (Fertilization Directive [50]). Documentation of handling of pond-sludge in the pond-book ("Teichbuch") incl. invoice. Controlling via water management office; rarely with random sampling, but burden of proof for the fish farm in case of an accident	Spreading on agricultural land, but needs to be recorded in regard to German "Düngeverordnung" (Fertilization Directive [50]). Documentation of handling of pond-sludge in the pond-book ("Teichbuch") incl. invoice. Controlling via water management office; rarely with random sampling, but burden of proof for the fish farm in case of an accident
e. Is your permission / license linked to a sludge quota (e.g. maximum allowable quantity per year)?	no	no
3.5. Feed		
a. Does your permission / license specify any limitation on the feed you use (e.g. brand, country of origin)?	Free in the decision of feed; but tries to use the most efficient feed to have a minimal environmental impact.	No restrictions in the licence. Can use any compound feed
b. Is there any specified requirement for the feed components, composition (e.g. feed specific N-, P- content, N-, P-discharge, faecal stability, digestibility)?	no	no
c. Is your permission / license linked to a feed quota (e.g. maximum allowable feed quantity per year)?	Yes, defined by intensity level ("Teichbauempfehlungen" [41])	no
3.6. Land / area usage		
a. Are you the owner of the land / area that you are using for production?	Both rented and owned. Sometime extension of farms will include rental of more area, then farmers have normally building on own land.	generally, yes; sometimes for lease
b. If you are not the owner, which legal status / agreement do you have with the actual owner (e.g. a lease contract)?	-	-
c. How does this ownership-status affect your rights in relation to production permission / licensing?	-	-
d. Is there an ABSOLUTE (irrespective of production volume) limitation on the area usage (e.g. expressed as ha water surface area)?	-	-
e. Is there a RELATIVE (in relation to production volume) limitation on the area usage (e.g. water surface area per kg produced, area per kg feed used)?	-	-

f. Do you have a requirement to work in different intensity levels on certain areas of your property (e.g. leaving one pond untouched as compensation area for producing in another pond)?	-	-
g. What are typical spatial planning conflicts with habitats, protected areas? Please give an example.	-	Site-specific noise pollution Disturbance of natural landscape with measures (e.g. enclosures) against predators or oxygen tanks or feed storage
h. How close is/are your farm(s) located to a protected environment (e.g. Natura2000, etc.)?	the river drainage area is partly a water protection area; no influence on the farm though.	distance approx. 1km
i. How does the site location affect the permission process (e.g. when located in or close to a Natura2000 site)? Please give an example.	-	Depending on the outcome of the assessments
j. Are there any areas that are PRECLUDED from trout farming (i.e. where the government really wants to have no farms)?	-	-
k. Are there any areas that are PRIVILEGED for trout farming (i.e. where the government preferably wants to have farms)?	Traditional pond-farming areas Summer-cool freshwater (e.g. Schwaben, Oberbayer. Alpenvorland, Niederbayern, Oberfranken, Mittelgebiergsregionen)	-
l. Does your fish farming permission / license regulate your property usage (e.g. in terms of percentage of land that must not be built on)?	No	no
3.7. Predators and other wildlife		

a. What "general" measures are you ALWAYS allowed to use against fish-eating predators (birds, otters, etc.) (e.g. noise deflection)?	Need hunting licence; netted against birds; problem is developing with otters at the river: future work will be otter-safe ponds with very high nets; big problem with grey herons (breeding colony close by). Damage is relatively high, especially due to the grey heron; 30-50 breeding pairs per year cause approx. 20.000 – 40.000 € damage; problem is not the feeding on fish, but the killing of fish while trying to catch some: it is difficult for them to get fish at the concrete flow channels; grey heron can be shot from 30.8. – 15.2. Netting of flow channels very expensive (70.000 – 100.000 €) and complex (building permission, etc.). No compensation for grey heron, only for cormorant; possible 50% subsidies from EMFF for the netting; but EMFF regulations are still not implemented in all Länder,	Enclosures/fencing Shooting Noise deflection Otters: e.g. high and stable fences or netting Very little damage; below 1000€ per year no compensation given
b. What "special" measures are you ONLY allowed to use against fish-eating predators (birds, otters, etc.) when you are in possession of a special license or in dedicated areas or times of the year (e.g. gun shooting only with hunters' license)?	Cormorant can be shot from 15.8. to end of march; regulations for cormorant hunting to be renewed in some Länder Needs a so called „Begehschein", to hunt within the farm (otherwise shooting is not allowed for hunters within a built-up area!)	Shooting of juvenile cormorant all-yearlong (7000-8000 shots); Cormorant-Management: 2 representatives doing research and working on shooting strategies. Simplified shooting licence with hunting-licence and if agreed with the owner of local hunting rights. Documentation obligation and reporting to district authority („Kreisverwaltungsbehörde") for publishing purposes. Grey heron: shooting not while breeding Great White Egret, Goosander: shooting not allowed; no problems with sea eagles Guidelines for net-building: „Teichbauempfehlung" [41]
c. What measures are you NOT allowed to use against fish-eating predators (birds, otters, etc.)?	Otters are strictly not allowed to be disturbed (punishment) Lots of otters especially in Niederbayern (East of Bavaria); Otter-Management is coming: prevention of otter immigration and consulting; compensation so far only in Niederbayern, but from 2016 in total Bavaria. Beavers are of less relevance	Otters are strictly not allowed to be disturbed (punishment) Lots of otters especially in Niederbayern (East of Bavaria); Otter-Management is coming: prevention of otter immigration and consulting; compensation so far only in Niederbayern, but from 2016 in total Bavaria. Beavers are of less relevance

d. Which of the above mentioned measures to use against fish-eating predators are most frequently used in your country?	-	-
e. Is there any practical experience / scientific documentation or other source of evidence for the effectiveness of these measures in your country? Please provide source name and web-link if applicable.	-	-
f. What other "problematic" interactions with other types of wildlife (other animals, plants, etc.) do occur?	-	-
g. How are they "typically" regulated? Please provide reference and web-link, if applicable.	-	-
3.8. Energy		
a. Does your permission impose any requirements / regulations on your energy consumption (e.g. maximum kWh use or kWh per kg produce)?	No	No
b. Are there any requirements to maximum amount or demands on reduction of energy used – when OBTAINING a MAINTENANCE license (if this is applicable in your country)? (e.g. per kilo produce, percent reduction to comply with - or otherwise?)	-	-
c. Are there any requirements to maximum amount of energy used - when OBTAINING a NEW LICENSE? (e.g. per kilo produce or otherwise?)	-	-
d. Does your farm have a connection to the public electricity grid or do you use other means to generate electricity? Please specify (e.g. Diesel generator, solar panels, proportion of renewable energy).	Public electricity grid; some farms with plans for photovoltaic on top of the building to reduce electricity costs;	public
e. Does your permission create any incentives / benefits to safe energy in production or to use renewable energy sources e.g. windmill, solar (Renewable energy sources is a must in organic production)	No	No
3.9. Interactions with other stakeholders		
a. What are "typical" regulations that affect your interaction with other stakeholders, like: (Please give examples and references, if applicable)		Currently none. Good image of the sector. Possibly animal welfare.

○ Recreational anglers	Often put & take fishing in combination with farm - no problem with anglers then.	No
○ Migrating fish organizations, conservation organizations	fish pass	Yes
○ Environmental NGOs		yes
○ Tourists and tourism industry		no
○ Agriculture, farmers		no
○ Water energy, power dam operators	Increasing water levels for the next river dam (tourism)	no
○ Others (please specify)		
3.10. Veterinary and animal welfare affairs		
a. How frequently are you interacting with your veterinarian?	Quite frequently; District veterinary: 2x per year for controls; "Qualifizierter Dienst", engl. Qualified person, controls 2x per year; the qualified person is supporting the federal fish health service and check on the self-controlling of the farmer	-
b. What are the most common reasons for you to work with a veterinarian?	Hygiene directive („Hygieneverordnung"); species-appropriate killing; fish disease regulations ("Fischseuchenverordnung"); residue analysis of food fish (medicine, heavy metals, etc.)	Export documents, processing controls, monitoring of farming Adjustment to applicable law
c. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Fish disease regulation ("Fischseuchenverordnung")	Fish disease regulation ("Fischseuchenverordnung")
d. What kind of veterinary approval is required to obtain the permission?	Stocking density (only for organic production)	-
3.11. Medicines & chemicals		
a. Are medicines only available after veterinary inspection and prescription?	yes	yes
b. Are you allowed to store veterinary prescribed medicines at your farm?	yes	yes
c. If yes to b: Under which conditions are you allowed to store medicines – and in which amount?	-	-
d. Is it mandatory to register the medicines in storage?	yes	yes
e. Are you allowed to apply the stored medicines at your own or only under veterinary instruction?	Only after prescription	Only after prescription

f. Is it mandatory to register the use of chemicals and medicines? If yes: How do you register?	Yes, diary	Yes, diary
g. What kind of medicines & chemicals are you allowed to use (e.g. formalin/ formaldehyde, salt, hydrogen peroxide)?	Disinfection of equipment with Formalin; no treatment of fish (?) Treatment according to demand Peroxide for prophylaxis	Disinfection of equipment with Formalin; no treatment of fish (?) Treatment according to demand Peroxide for prophylaxis
h. What kind of medicines & chemicals are you NOT allowed to use that you historically did use (e.g. malachite green)?	-	-
i. Which of these substances do you use regularly to treat your fish?	-	-
j. Please list the medication you normally use (based on a veterinary prescription).	-	None. Documentation in livestock records (“Bestandsbuch”)
k. Do you use vaccinated fish in your production?	No vaccination until 2014; then red-mouth-disease was 'introduced'; since then vaccinating all the fish (vaccine is ordered with the vet); costs approx. 10.000€ per year.	Vaccination not common; maybe against Furunculousis
l. Do you vaccinate yourself or do you buy already vaccinated stocking material?	-	-
m. Which of these substances do you use regularly for other purposes (e.g. disinfection between production cycles, disinfection of equipment)?	Almost no medication, no antibiotics; works in most years (last year not possible - hot summer); Salt (needs an approval, but nobody does that) Peracetic acid Commercial products	Lime Per acetic acid Salt Caustic soda Disinfectant No regulations for discharge water
n. What are relevant limitations for the use of these substances (e.g. maximum allowable use of a disinfectant per production/per water-volume/per kg-fish)?	-	-
o. What special regulation exists for effluent water containing residuals from medicinal or chemical treatment (e.g. maximum residual concentration)?	No. Only regulations about the waiting time before fish can be sold.	-

6.1.2.3 SELF-MONITORING AND REPORTING REQUIREMENTS ON FARMS

The self-monitoring is mostly pertaining to fish health and welfare monitoring. The veterinary authorities of the districts, the qualified services and fish stock supervising veterinarians (free-lance) assume an important role in interacting with the fish farmer. They are the ones who visit the farms most frequently and have the far reaching understanding to deduce any changes in farm management and operation that might potentially be necessary. Due to the limited scope of their formal obligation (mostly hygiene and animal welfare) they are free to provide further recommendations to the farmer, instead of being part of the authority control system.

A similar important role assumes regional fisheries advisors (Fischerei-Fachberater) in the federal state of Bavaria. They also visit the farms quite frequently and can provide guidance and recommendations. They also have an only marginally controlling role, which helps in the unprejudiced cooperation with farmers.

Table 9 Questionnaire. GERMANY. Section 5.

5.1. Environmental self-monitoring	FLOW THROUGH	SEMI-RAS
a. What information (in relation to the above mentioned restrictions) do you routinely monitor and document yourself as a farmer? Please indicate these metrics here, unless you haven't already done so in the beginning of the questionnaire (see 1.)	Everything necessary for the tax office; For the vets: purchase of fish, selling of fish, inventory list, feed amounts; Self-control: Water parameters, pH, Oxygen, temperature; chemical water parameters useless due to high water flow rates	everything
○ Production size, i.e. quantity of fish produced	-	Yes, yearly
○ Use of different facilities (e.g. ponds or raceways)	-	-
○ Water (i.e. quantity and quality parameters)	-	-
○ Sludge	-	yes
○ Feed	-	yes
○ Land / area usage (additional to facility)	-	yes
○ Energy	-	no
○ Medicines, chemicals	-	yes
b. How do you monitor and document (writing/filling out tables/formulas in paper, electronically using software on a computer)?	Electronic and manual records	PC
c. Are there regulations that specify how to do the self-monitoring?	-	Part of the licence
d. Is there specific equipment required to monitor (e.g. special types of probes to be used for water quality)?	-	Yes, e.g. photometer
e. When, how and by whom are your self-monitoring documents checked?	-	County annually and according to demand
f. How long do you need to store them?	10 years	10 years, annual report
g. Can you provide us with a (blank) copy of your self-monitoring documents as an example?	-	-
h. What happen if your self-control measures are out of bounce/beyond the limits of your license?	„Qualifizierter Dienst" reports to authority; authority reacts;	Warning by county authorities and improvement guidelines
i. What are the consequences….?	-	-

j. What do you do as a fish-farmer to correct "faulty" measurements?	-	-
5.2. Environmental controls		
a. Who conducts environmental controls (e.g. authority, delegated institution or the farmer himself)?	-	Self-control 12 times per year County 1-6 times per year Keeper of the river ("Gewässerwart") 2 times per year
b. How frequently are you controlled?	-	-
c. Are the controls announced or spontaneous?	Controls are not announced, but don't happen very often	spontaneously
d. What kind of documentation is required?	-	-
e. What does the controlled check (e.g. environmental index in the receiving waterbody (flora & fauna indexes), other types of measuring possible impacts)?	-	Water samples

6.1.2.4 PERFORMANCE OF PERMISSION

Table 10 Questionnaire. GERMANY. Section 6.

6.1. Your experience with permission	FLOW THROUGH	SEMI-RAS
a. Did you ever have to apply for a license to MAINTAIN, OBTAIN NEW or OBTAIN EXPANSION license?	-	-
b. How long did it take in your case to get the license?	-	-

c. What negative experiences did you make?	Depending on the authority; all decisions are made by the authority and the people working there (arbitrariness is a big problem); the contact with the authority could be good or not so good; in general good relation to the vets. Ideas for improvement: Currently no obligatory guidelines for authorities, only recommendations for action; generates too much room for individual actions; great differences in the interpretation of recommendations between the German federal states; common German policy would be much better! In Lower Saxony GMP guidelines, but only for orientation. Important: New BAT's or GMP's should only be developed together with the farmers - to get the important practical input of people that are working with fish every day!	The topic of nutrient outflow into waters is currently difficult for trout farming
d. What positive experiences did you make?	-	-
6.2. In your country in general		
a. How many NEW production licenses have been granted in the last 1, 5, 10 years?	-	-
b. How many existing production licenses have been CHANGED in the last 1, 5, 10 years?	-	-
c. In how many cases was the production volume increased?	-	-
d. What was the success rate of applications in the last 1, 5, 10 years?	-	-

6.1.3 ITALY

The questionnaire was carried out at 10 Italian trout farms, of different sizes (from 20 tons /year to more than 1.000 tons/year) and types of production (hatchery, on-growing for human consumption and for restocking/put and take fisheries) all in a flow through system. The water supply system is mostly mixed with wells and spring or river derivation. The fish farms are located in the North of the country (Regions: Piemonte, Lombardia, Veneto, Trentino and Friuli).

The answers are representative for the whole Italian trout sector and cover the variety of the possible situations encountered in farms.

The Italian online repositories for legal texts were impossible to be effectively searched, without in-depths understanding of the Italian legal structure. Instead, the legal text repository of the Italian producer association API was used, when applicable (http://www.api-online.it/index.cfm/it/area-legislativa/).

6.1.3.1 OBTAINING PERMISSION / LICENSE FOR TROUT PRODUCTION

Procedures and applications necessary for a new trout farm in Italy [25]:

1. The municipal building commission;
2. Permission from the local board of health;
3. Permission from the provincial office for the protection of environmental resources;
4. Opinion of Chamber of commerce;
5. "*nulla-osta*" from the regional division of forestry;
6. "*nulla-osta*" from the Mountain Community (for the Alpine region);
7. Authorisation from the responsible authorities to discharge water;
8. if the new fish farm is located in areas subject to special protection laws, a *"nulla-osta"* is necessary from each public body entrusted with the protection of the area.

The different laws associated with those steps show, that the Italian law system has multiple entities involved in the process. The following steps have to be taken (number in brackets refer to the table below):

- Apply for a building permit (1) that is thought from the local government.
- An EIA (2) can be necessary as the second step.
- The area must be confirmed free to use (3).
- A concession for water abstraction is necessary for water abstraction greater than 100 l/sec (4).
- An animal health authorization and a food safety, health and hygiene authorisation with the local health authority have to be sought (5).
- A health and safety inspection has to be granted by the local fire brigade (6).
- Alien species and others (7).

Table 11 IT. DG MARE workshop table.

	Description of laws and legal areas relevant for trout production in Italy (quoted from DG MARE workshop material, Good practices in administrative simplification for the promotion of sustainable aquaculture – 18-19 November 2015). All credit to the author.
(1)	Concessione edilizia (building permit) granted by the Comune (local government) but several other public bodies (former provinces, local health authorities) have to give their consent, which is binding for building permission. Building permit is granted under the Law 28/02/1977 n.10 e the Presidential Decree D.P.R. 390/2001, and subsequent modifications and integrations. Time required 3-6 months, but sometime is delayed up to 1 year. Please note that the health legislation places fish farms in the "unhealthy industries first class" (List in DM 09/04/1994), in accordance with Art. 216 of Health Laws R.D. 27/07/34, n. 1265, "those processes that have to be isolated in the countryside and kept away from the houses." Technical document to be provided are established by each municipality in accordance with relevant building regulations. Around 20-25 documents must be submitted by the applicant, and the time required to complete this step in the procedure can vary substantially.
(2)	An EIA is required for new aquaculture farms. The EIA is evaluated by the national and/or regional government depending on the relevance of the project. Other public bodies are consulted. EIA is generally required for intensive fish farming on surface exceeding 5ha. In some Region (eg Liguria), EIA is applied also to shellfish culture. The applicant has to provide 8-10 documents, and this step typically may take from 5 to 24 months. Two decisions of the Court of Justice (2011) and of the Constitutional Court (2010) provided new elements for those farm built before EIA legislation, but with building characteristics (building, surface, location,..) requiring a EIA according to the new national legislation (Legislative Decree no. 152/2006) and regional laws. For aquaculture farms in Natura 2000 sites, additional environmental impact analysis is required (Habitats Directive 92/43/CEE, D.P.R. 357/97, D.M. 03/04/2000). The final decision of the process is given a pronunciation environmental compatibility, (art.5 D.P.R. 357/97) in the form of Regional Council Resolution. This step typically takes 24 months.
(3)	Tutela dei beni ambientali e paesaggistici (heritage, landscape and environmental protection): the regional government," soprintendenza per i beni culturali" and the national Ministry for cultural heritage have to confirm that the area where the farm is planned is not restricted for heritage/landscape/environmental protection. The applicant has to submit 10 documents, and this step takes 4-5 months. Vincolo idrogeologico: the regional or local government must confirm that the area is not subject to restrictions for hydrogeological reasons. The applicant has to submit 7 documents and this step takes around 2 months.
(4)	Concessione captazione acqua (concession to abstract surface or groundwater): this is granted by the province or national government depending on the amount of water involved (100l/sec). The applicant has to submit 8-16 documents and this step typically takes 3-6 months. However duration of concession is very limited (in some case year by year), and a EIA is now requested for old concession never subjected to a EIA.
(5)	Autorizzazione igienico-sanitaria: the licence is granted by the local government (Comune). This requires 5 documents and usually 1-2 months. Processing plants are authorized according to approval (Reg. 853/2004). The application form and the above documentation must be submitted to the veterinary service of the local health responsible for the area, which evaluates and validates the inquiry. The granting of authorization is the responsibility of the Regional Veterinary Valet (or local health unit if delegated).
(6)	Conformita' dei Vigili del Fuoco: the local fire brigade (Comando provinciale dei vigili del fuoco) has to confirm that the farm respects all relevant H&S rules. This involves an inspection and 3 documents to be submitted by the applicant, and usually takes 1,5 to 3 months.

(7)	Autorizzazione sanitaria in acquacoltura: authorisation and inclusion in the national registry (Registration, Reg. 852/04; recognition Reg. 853/04) of each establishment under their control; this is done by the veterinary service of the local health agency (Servizio veterinario Azienda Sanitaria Locale); depending on the type of farm, the documents to be submitted by the applicant can be between 2 and 6, and this step typically takes 1 (+ 3 second audit) months to complete. Registration / sanitary authorization for fish farms and processing plants under the law 148/08 (implementing Directive 2006/88 / EC) is compulsory for all aquaculture farms that raise animals or hold even temporarily , at the Veterinary Service of the ASL responsible for the area. The Register of fish farm (Anagrafe, DM 8 July 2010) include information of companies and the alphanumeric code of breeding.

Table 12 Questionnaire. ITALY. Section 2.

2.1. Type of permission	
a. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Water concession (related to WFD for in-land farms) Authorization to water discharge (also related to WFD)
b. What permission(s) is/are needed to OBTAIN the license for EXPANSION of an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Water concession (related to WFD for in-land farms) Authorization to water discharge (also related to WFD – implemented with D.Lgs 152/2006) [51] Building permit (for expansion if there are expected structural changes)
c. What permission(s) is/are needed to OBTAIN the license to establish a NEW trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Water concession (related to WFD for in-land farms) Authorization to water discharge (also related to WFD) Building permit (for a new farm): emitted by Municipality (after specific request) requires positive opinion of: Province, Local Environmental and Sanitary Authority and preliminary checks regarding limits, constraints, … Activity registration (Reg. CE 852/04) [52] Aquaculture enterprises sanitary authorization (Dir. CE 2006/88) [52]
d. Who can apply for such a permission (e.g. farm owner, producer association)?	Entrepreneur Agricultural Professional (Imprenditore Agricolo Professionale -I.A.P.) or Farmer cooperative other types of enterprises
e. What qualification is needed to apply (e.g. work experience as farmer, relevant degree or diploma)?	Qualification as IAP or work experience
f. How long is a permission valid?	For Water concession: Duration cannot exceed 40 years (agriculture and fish farming). Authorization to water discharge: Duration: 4 year (could be 15 is done by Unique Environmental Authorization), renewal must be required one year before expiring.
g. How frequently do you have to re-apply?	See before
h. There a difference between “old” licenses and new licenses (e.g. license stemming from before 1992, Foundation of EU)?	Legislative Decree no. 152/2006 (WFD implementation) [51] intervenes also on the licensing system by specifying that the region may limit the derivations in place at any time for reasons of public interest, even based on the identification, carried out in collaboration with the Basin Authority, of areas subject to time or quantitative limitations.

i. If there are such "old" licenses, what are the main practical differences to new licenses?	See before
j. What kind of permission do you have for your farm?	NA
2.2. Legal framework	
a. Which laws (laws/departmental orders/ statutory instruments/directives/guidance and/or other forms of public regulations) are applied to regulate the permission process (see 2.1)? Please indicate if the laws are specific for aquaculture (A) or of a more general nature (G). Please give full name (in national language and English translation if possible) and link to website (if applicable).	For water concession, the basic rule is the Royal Decree 1775/33, which over time has undergone a number of changes and additions; Significant those introduced in recent years by the Legislative Decree no. 152/2006 [51].
b. On which regional level(s) are these laws effective (e.g. whole country, state, region, municipality)?	whole country with some regional differences
c. How frequently are the relevant laws changed?	-
d. When was the last major / relevant change in the laws, concerning aquaculture, that you can remember?	Legislative Decree no. 152/2006 [51]
e. Was this change directly related to an election or a new political party taking over the government?	No, we do not think so
f. What was the motivation for this change in the laws?	WFD implementation
g. What was your opinion on the necessity / meaningfulness of this change?	Necessary to implement EU Rules
2.3. Permitting authority	
a. Where do you have to apply? Please give full affiliation of the MAIN permission granting authority and link to website (if applicable).	Water concession. The regions have competence for the approval of concessions for both large (> 100 litres / second), and for the small derivation (<100 litres / second), but often they delegate some of these responsibilities to the provinces (the province is an institution currently under discussion)
b. Please indicate the geographic coverage of the authority's responsibility (e.g. for the whole country, federal state, county, municipality, city).	Region
c. Which further authorities are involved in the process? Please give affiliations.	-
d. Is there any mandatory third party involvement in the application process (e.g. research institutes, state agencies, third party experts; e.g. for statements, review of application)?	A set of special rules for the management of protected areas by art. 164 of Law 152/2006 [51] (Environmental Code). The integrated water service company may also enter into agreements with the state, the regions, local authorities, associations and agricultural universities of collective domains holders, for the direct management of public or collective domains falling within the scope of the aforementioned areas, in compliance of the protection of nature and taking into account the civic use rights exercised.

2.4. Application process to achieve production permit	
a. Is there more than one application necessary to MAINTAIN a license?	The same of point 1.f, with some simplifications
b. Is there more than one application necessary to OBTAIN a NEW license?	Authorization procedure for the issuance of license, briefly: Initiative, request of one party. Advertising. Inquiry. Decision-granting of the concession. Recording. In many case this authorization may be subject to the Services Conference (Conferenza dei Servizi) meeting in which are invited public authorities and key stakeholders in relation to the use of water.
c. Is there more than one application necessary to OBTAIN an EXPANSION of an existing license?	The same of point 1.f, with some simplifications
d. Can you draw a (generic) flow-diagram for the license process, beginning with the preparation of the application until the final decision, including all parties involved and the main milestones ((see example in Appendix page 180)?	There are too many variants
e. Are there templates or guidelines available for the application? Please provide reference / source.	In some cases, there is also the support of API (Italian Fish Farmers) Farmers 'Vademecum'
f. In which language can you / do you have to apply?	Italian
g. How much does the application cost (e.g. administrative fee for obtaining the license)?	The application cost. It varies a lot, although in some cases there are only the stamp duties costs
h. Is there a fee for the license as such (e.g. fee per production volume/area, etc.; apart from any administrative cost)?	The public water use for aquaculture purposes is subject to payment of an annual fee collected by the Region. The same body shall ensure the annual amounts due and determined by usage and the quantities used.
i. What is the official expected time to process the application (until decision – weeks? months? Or years?)?	Years…
j. How long does it actually take to get a license (e.g. based on the average of the last application process you know)?	At least 18 months … it could be more than 5 years
k. What are the main causes for delays in the process (e.g. expert & public hearings, appeals, environmental impact assessments (EIA), law suits, etc.)?	All mentioned: expert & public hearings, appeals, environmental impact assessments (EIA), law suits,..
l. Is there a legally binding maximum time the authorities can work on the application before giving a decision?	Not actually
m. What documentation is needed for the application (e.g. map, GPS-location, description of facility, technical sketches, technical leaflets)? (See also questions to the use of specific technologies in section 2 and 3, below)	Documentation: drawings, technical report, bill of quantities, financial plan, in some cases EIA, etc … Highly variable approach from Region to Region
n. If there is more than one application involved in the process, how do the applications interact?	Highly variable approach from Region to Region
o. Is there one application that is superior to the others?	-
p. Are the application processes completely separated from each other?	Highly variable approach from Region to Region

q. How do the different authorities interact with each other (e.g. based on a formalized procedure)?	Highly variable approach from Region to Region
r. What happens if one application is rejected?	Highly variable approach from Region to Region
s. What kind of written "proof" (e.g. verdict, official letter, certificate) do you receive in the end?	Official letter and in many cases publication on an Official journal
t. What is easier? Apply for a renewal of an existing license or apply for a completely new license?	The renewal, but usually there is a reduction of the water granted volume.
u. What kind of application process did you have to go through?	NA
v. Can you give us a copy of this document for your farm? (permit/license to produce and/or water abstraction permit/license).	(Attached a copy)
w. What are the possibilities to complain or appeal a decision of refusal?	NA
x. Does the fish farmer have to appeal himself or will the farmer's organization do it/assist the farmer?	NA
y. Will an appeal be dealt with by public authorities directly or will it be necessary to start private proceedings?	NA
z. Can the expenses for an appeal be estimated?	NA
aa. What is he expected time span for the appeal to be accomplished?	NA

6.1.3.2 RELEVANT RESTRICTIONS IN RELATION TO PERMISSION / LICENSE

The diverse regional structures and legislations therein make it very difficult to draw a common conclusion on the restrictions in relation to permission and license.

Table 13 Questionnaire. ITALY. Section 3.

3.1. Size	
a. Is there a production size limit for the permission (e.g. maximum production volume, feed usage, water usage, area)?	The volumes of water granted shall be commensurate with the possibilities of water saving and reuse of resources and must guarantee the minimum vital flow (DMV), which in the case of derivations from the river is the major constraint
b. What is the maximum size of your production you are allowed to have?	NA
c. Are there different requirements for different sizes of production (e.g. full EIA for a large farm, less detailed investigation for a small farm)?	There are simplifications if the production is under 100 tons/year.
d. What are the thresholds, if any?	See before, other specific restrictions are related to the site environmental characteristics
e. In case, permissions are limited by production size, can you apply for more than one permission?	Can vary case by case
f. What are the conditions for doing so?	-
3.2. Facility type	
a. Are there different requirements for different facility types (e.g. earthen ponds, concrete ponds/raceways, indoor/outdoor, flow-through, partly-recirculated, located in country-side or in an industrial area)?	related to the site environmental characteristics;

b. Is there any kind of production facility that would be generally considered IMPOSSIBLE to get a permission for (e.g. see above)?	related to the site environmental characteristics
3.3. Water	
a. How much INTAKE water are you allowed to use?	NA
b. What OUTLET water composition do you have to fulfil?	NA
c. Is there an ABSOLUTE (irrespective of production volume) limitation on the intake / outlet water QUANTITY (e.g. expressed as litre per second or percentage of a river flow)?	The minimum vital flow (DMV), which in the case of derivations from the river is the major constraint. There are also limitation in the case of water underground extraction.
d. Is there a RELATIVE (in relation to production volume) limitation on intake / outlet water QUANTITY (e.g. volume per kg produced, volume per kg feed used)?	Not usually, specific limitations in Natura 2000 areas
e. Are there ABSOLUTE requirements for the COMPOSITION of outlet water (e.g. maximum content of nitrogen, maximum suspended solids)?	They must comply with the quality standards set by Legislative Decree 152/2006 [51]; Furthermore, there are specific requirements for certain areas (e.g. fish farms falling into basins downing in lagoons - i.e. Venice Lagoon)
f. Are there RELATIVE requirements for the COMPOSITION of outlet water (e.g. nitrogen discharge per kg produced)?	All discharges are regulated according to the compliance with the quality objectives of water bodies and must still comply with the limit values specified in Annex 5 to Part Three of the Decree. 152/2006 [51] and take into account the maximum permissible load and best available techniques.
g. Are there RELATIVE or ABSOLUTE requirements for the COMPOSITION of outlet water in relation to the flow (e.g. e.g. nitrogen discharge per litre outlet flow and/or related to concentration in the inlet flow – in other words: additive load per water volume)?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
h. Is there a fee/cost for using/abstracting the water from the river/the well? If so, what are the cost/fee?	The public water use for aquaculture purposes is subject to payment of an annual fee collected by the Region. The same body shall ensure the annual amounts due and determined by usage and the quantities used.
i. Is any or all of the above restrictions limiting the production on your site (e.g. when your river / well has more capacity than you actually are allowed to use)?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
3.4. Sludge	
a. Is it mandatory to collect and remove sludge?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
b. Is there an ABSOLUTE limitation on sludge quantity (e.g. tons of dry matter per year)?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
c. Is there a RELATIVE limitation on sludge quantity (e.g. kg sludge per kg produced)?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
d. What further usages of sludge are allowed (e.g. as fertilizer, biogas, composting, dumping)?	The shedding of sludge (equivalent compared to agriculture wastes) is subjected to the Unique Environmental Authorization that prescribes the specific rules to their collection and use

e. Is your permission / license linked to a sludge quota (e.g. maximum allowable quantity per year)?	The shedding of sludge (equivalent compared to agriculture wastes) is subjected to the Unique Environmental Authorization that prescribes the specific rules to their collection and use
3.5. Feed	
a. Does your permission / license specify any limitation on the feed you use (e.g. brand, country of origin)?	Related to general EU, National rules of feed use
b. Is there any specified requirement for the feed components, composition (e.g. feed specific N-, P-content, N-, P-discharge, faecal stability, digestibility)?	Related to general EU, National rules of feed use
c. Is your permission / license linked to a feed quota (e.g. maximum allowable feed quantity per year)?	Related to general EU, National rules of feed use; recording of quantities and communication to authorities
3.6. Land / area usage	
a. Are you the owner of the land / area that you are using for production?	vary case by case
b. If you are not the owner, which legal status / agreement do you have with the actual owner (e.g. a lease contract)?	It varies case by case: different types, farmer, company partnerships, enterprises, cooperatives, cotter, leaseholder
c. How does this ownership-status affect your rights in relation to production permission / licensing?	vary case by case
d. Is there an ABSOLUTE (irrespective of production volume) limitation on the area usage (e.g. expressed as ha water surface area)?	vary case by case
e. Is there a RELATIVE (in relation to production volume) limitation on the area usage (e.g. water surface area per kg produced, area per kg feed used)?	vary case by case
f. Do you have a requirement to work in different intensity levels on certain areas of your property (e.g. leaving one pond untouched as compensation area for producing in another pond)?	vary case by case
g. What are typical spatial planning conflicts with habitats, protected areas? Please give an example.	Environment use, industrial activities, terrestrial animals intensive farms
h. How close is/are your farm(s) located to a protected environment (e.g. Natura2000, etc.)?	At least 20 % of Italian trout farms are near or in the buffer zones of Natura 2000
i. How does the site location affect the permission process (e.g. when located in or close to a Natura2000 site)? Please give an example.	Environmental Impact Assessment/Evaluation are requested for SCI –under Natura 2000.
j. Are there any areas that are PRECLUDED from trout farming (i.e. where the government really wants to have no farms)?	Yes, specific protected areas are precluded from trout farming
k. Are there any areas that are PRIVILEGED for trout farming (i.e. where the government preferably wants to have farms)?	No, last licence for trout farm in Italy, we have notice, was given in 2009/2010
l. Does your fish farming permission / license regulate your property usage (e.g. in terms of percentage of land that must not be built on)?	Yes, specific measures are provided by urban / rural planning.
3.7. Predators and other wildlife	
a. What "general" measures are you ALWAYS allowed to use against fish-eating predators (birds, otters, etc.) (e.g. noise deflection)?	Protective nets, fences

b. What "special" measures are you ONLY allowed to use against fish-eating predators (birds, otters, etc.) when you are in possession of a special license or in dedicated areas or times of the year (e.g. gun shooting only with hunters' license)?	Noise deflection, only in some specific areas gun shooting only with hunters' license … For otters gun shooting with hunters' license, they are now considered like invasive species.
c. What measures are you NOT allowed to use against fish-eating predators (birds, otters, etc.)?	Usually gun shooting with hunters' license in the case of birds
d. Which of the above mentioned measures to use against fish-eating predators are most frequently used in your country?	Protective nets, fences
e. Is there any practical experience / scientific documentation or other source of evidence for the effectiveness of these measures in your country? Please provide source name and web-link if applicable.	-
f. What other "problematic" interactions with other types of wildlife (other animals, plants, etc.) do occur?	-
g. How are they "typically" regulated? Please provide reference and web-link, if applicable.	-
3.8. Energy	
a. Does your permission impose any requirements / regulations on your energy consumption (e.g. maximum kWh use or kWh per kg produce)?	-
b. Are there any requirements to maximum amount or demands on reduction of energy used – when OBTAINING a MAINTENANCE license (if this is applicable in your country)? (e.g. per kilo produce, percent reduction to comply with - or otherwise?)	NA
c. Are there any requirements to maximum amount of energy used - when OBTAINING a NEW LICENSE? (e.g. per kilo produce or otherwise?)	NA
d. Does your farm have a connection to the public electricity grid or do you use other means to generate electricity? Please specify (e.g. Diesel generator, solar panels, proportion of renewable energy).	The energy cost is one of the highest sustained by fish farms that use well water, even so does not yet exist a clear and rewarding policy in support of renewable sources in aquaculture (photovoltaic, but also micro hydroelectric power)
e. Does your permission create any incentives / benefits to safe energy in production or to use renewable energy sources e.g. windmill, solar (Renewable energy sources is a must in organic production)	-
3.9. Interactions with other stakeholders	
a. What are "typical" regulations that affect your interaction with other stakeholders, like: (Please give examples and references, if applicable)	
○ Recreational anglers	Vary at local level, case by case
○ Migrating fish organizations, conservation organizations	Vary at local level, case by case
○ Environmental NGOs	Vary at local level, case by case
○ Tourists and tourism industry	Vary at local level, case by case
○ Agriculture, farmers	Some conflicts for water access
○ Water energy, power dam operators	Many conflicts for water access
○ Others (please specify)	-

3.10. Veterinary and animal welfare affairs	
a. How frequently are you interacting with your veterinarian?	Biosecurity and welfare check list are due to Aquaculture enterprises sanitary authorization (Dir. CE 2006/08)
b. What are the most common reasons for you to work with a veterinarian?	NA
c. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	NA
d. What kind of veterinary approval is required to obtain the permission?	Activity registration (Reg. CE 852/04) Aquaculture enterprises sanitary authorization (Dir. CE 2006/08)
3.11. Medicines & chemicals	
a. Are medicines only available after veterinary inspection and prescription?	NA
b. Are you allowed to store veterinary prescribed medicines at your farm?	NA
c. If yes to b: Under which conditions are you allowed to store medicines – and in which amount?	NA
d. Is it mandatory to register the medicines in storage?	NA
e. Are you allowed to apply the stored medicines at your own or only under veterinary instruction?	NA
f. Is it mandatory to register the use of chemicals and medicines? If yes: How do you register?	NA
g. What kind of medicines & chemicals are you allowed to use (e.g. formalin/ formaldehyde, salt, hydrogen peroxide)?	Only 4 active principles, are present in authorized VMPs and few vaccines, and other VMPs used applying the “cascade principle”.
h. What kind of medicines & chemicals are you NOT allowed to use that you historically did use (e.g. malachite green)?	Malachite green, cloramphenicol, and biocides in contact with fish
i. Which of these substances do you use regularly to treat your fish?	Only active principles, present in authorized VMPs and few vaccines,
j. Please list the medication you normally use (based on a veterinary prescription).	The authorized VMPs are used only as medicated feed based on a veterinary prescription
k. Do you use vaccinated fish in your production?	Yes, usually (Red Mouth Disease), and in some case against lactococcosis)
l. Do you vaccinate yourself or do you buy already vaccinated stocking material?	Yes usually
m. Which of these substances do you use regularly for other purposes (e.g. disinfection between production cycles, disinfection of equipment)?	Lime for tanks hydrogen peroxide, peracetic acid, iodine compounds for equipment.
n. What are relevant limitations for the use of these substances (e.g. maximum allowable use of a disinfectant per production/per water-volume/per kg-fish)?	-
o. What special regulation exists for effluent water containing residuals from medicinal or chemical treatment (e.g. maximum residual concentration)?	Legislative Decree 152/2006 [51]

6.1.3.3 SELF-MONITORING AND REPORTING REQUIREMENTS ON FARMS

Table 14 Questionnaire. ITALY. Section 5.

5.1. Environmental self-monitoring	
a. What information (in relation to the above mentioned restrictions) do you routinely monitor and document yourself as a farmer? Please indicate these metrics here, unless you haven't already done so in the beginning of the questionnaire (see 1.)	Monitoring and information requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
○ Production size, i.e. quantity of fish produced	YES, vary locally
○ Use of different facilities (e.g. ponds or raceways)	No
○ Water (i.e. quantity and quality parameters)	Monitoring water quantity (related to minimum vital flow) and quality parameters are laid down in the authorization measure.
○ Sludge	Specific prescriptions for sludge use and removal are laid down in the authorization measure
○ Feed	No
○ Land / area usage (additional to facility)	Specific prescriptions are laid down in the authorization measures
○ Energy	No
○ Medicines, chemicals	Following Legislative decree 193/2006 [53] (on VMPs) and 152/2006 [51]
b. How do you monitor and document (writing/filling out tables/formulas in paper, electronically using software on a computer)?	Specific records must be submitted to the licensing authority; other can be registered in paper tables or using software.
c. Are there regulations that specify how to do the self-monitoring?	The regulations on how to do the self-monitoring are laid down in the authorization measures
d. Is there specific equipment required to monitor (e.g. special types of probes to be used for water quality)?	It is not compulsory
e. When, how and by whom are your self-monitoring documents checked?	The regulations on how to do the self-monitoring are laid down in the authorization measures
f. How long do you need to store them?	At least five years
g. Can you provide us with a (blank) copy of your self-monitoring documents as an example?	-
h. What happen if your self-control measures are out of bounce/beyond the limits of your license?	Corrective measures must apply.
i. What are the consequences….?	The competent authority for any exceedances definitely be taken into account upon renewal, there are also penalties the amount of which it depends on the severity of the failure to respect the limits
5.2. Environmental controls	
a. Who conducts environmental controls (e.g. authority, delegated institution or the farmer himself)?	Usually Regional Agencies for Environmental Protection or local authorities
b. How frequently are you controlled?	Changes from case to case, and on geographical bases generally from one to four times a year
c. Are the controls announced or spontaneous?	Usually spontaneous
d. What kind of documentation is required?	Self-controls documentation, on farm records,
e. What does the controlled check (e.g. environmental index in the receiving water-body (flora & fauna indexes), other types of measuring possible impacts)?	Water quality parameters, in some cases Extended Biotic Index, Daphnia magna toxicity index, …, on farm records, ...

6.1.3.4 PERFORMANCE OF PERMISSION

Table 15 Questionnaire. ITALY. Section 6.

6.1. Your experience with permission	
a. Did you ever have to apply for a license to MAINTAIN, OBTAIN NEW or OBTAIN EXPANSION license?	-
b. How long did it take in your case to get the license?	At least one year (also for renewal)
c. What negative experiences did you make?	Long time required, excessive bureaucracy
d. What positive experiences did you make?	-
6.2. In your country in general	
a. How many NEW production licenses have been granted in the last 1, 5, 10 years?	In trout no new license after 2010
b. How many existing production licenses have been CHANGED in the last 1, 5, 10 years?	Only few
c. In how many cases was the production volume increased?	Only in few cases, as opposed there has been a slight decrease in production in many cases
d. What was the success rate of applications in the last 1, 5, 10 years?	No new applications after 2010 only renewals

6.1.4 POLAND

6.1.4.1 OBTAINING PERMISSION / LICENSE FOR TROUT PRODUCTION

Inland water fishing is regulated by Inland Water Fisheries Law. Inland fishing management is also subject to the provisions of water law, civil law, environmental law, natural protection law, animal health protection law and the provisions concerning the fight of animal diseases. [14]

General legal framework:

- Prawo wodne – Water Law Act [54]
- Prawo ochrony środowiska – Environmental Protection Law [55]
- Rybactwie śródlądowym – Inland Fisheries Law [56]
- Prawo budowlane – Building Law [57]
- Szereg przepisów weterynaryjnych – veterinary directives pack

These laws are valid for the whole country. Additionally, the Regional Water Management Bodies (Regionalny Zarząd Gospodarki Wodnej, RZGW) is giving out regional acts, also those, in which they introduce new methods of calculating the disposable water for certain river.

Legal acts – major differences in interpretation between local authorities. Relevant local authorities provide descriptions of application process. e.g. http://archiwum.ekoportal.gov.pl/prawo_dokumenty_strategiczne/Przewodnik_dla_spoleczenstwa/C11.html

The description document contains i.a. a list of the required annexes for the application:

- operat wodnoprawny (1 copy + electronic version)
- building project meets the requirements of the sampling water law
- decision on the location of investment of public purposes or decision on building conditions. If there is a local zoning plan - extract from this plan.
- draft guide to water management or manual management of water
- hydro-geological documentation (1 copy)
- consent of the owner of the sewage system
- decision on environmental conditions of the investment
- other (arrangements with landowners, owners of water and water facilities, the authorization or power of attorney to represent the applicant in the proceedings wodnoprawnym etc.)

The website http://archiwum.ekoportal.gov.pl provides many useful descriptions of the water permit framework and its related fees for non-commercial users. It also contains a list of all relevant national legislation in this context, dated until the year 2011. This website is well translatable with Google-translate (https://translate.google.de/translate?hl=de&sl=pl&tl=en&u=http%3A%2F%2Farchiwum.ekoportal.gov.pl%2Fprawo_dokumenty_strategiczne%2FPrzewodnik_dla_spoleczenstwa%2FC72.html), but apparently is outdated (labelled as archive). We were not able to translate the recent version of the same site (http://www.ekoportal.gov.pl/).

An expert has to prepare the water permit document (Operat wodnoprawny). This document describes the planned investments, showing water resources and analysing the current situation in the river. If the water is to be taken from underground, there has to be hydrologic expertise. This is typically realized as a consultancy service. A conclusive example of the services provided can be found here http://www.wodnoprawne.pl/ (translated with Google translate: https://translate.googleusercontent.com/translate_c?depth=1&hl=de&rurl=translate.google.de&sl=pl&tl=en&u=http://www.wodnoprawne.pl/pozwolenia.html&usg=ALkJrhjHPfRrHckAzybOJZD5kFcCZpj-KA#operat%20wodno-prawny) (no endorsement for the information provided on this website).

One interview provided a copy of a Polish water permit, issued by the district authority (Starostwo Powiatowe) for one of his fish farm locations. The document is three pages long and is written in Polish language. It contains i.a. a table of the total annual and the average monthly permitted water abstraction volumes (in m³ per

year) and further (numeric) specifications on the pump power (kW) of the main abstraction point and its location (indication of running km) on the river.

Table 16 Questionnaire. POLAND. Section 2.

2.1. Type of permission	
a. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Pozwolenie wodnoprawne (water permit) Zatwierdzenie z inspekcji weterynaryjnej (Veterinary Inspection permit with veterinary number). There is no link to website, this permissions are processed and given by the local authorities.
b. What permission(s) is/are needed to OBTAIN the license for EXPANSION of an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	1: Zgoda środowiskowa (Environmental Permit) 2: Decyzja o warunkach zabudowy (Decision on outline planning and spatial development) 3: In some cases: Raport oddziaływania na środowisko (EIA) – lack of clear criteria, for example, when production exceeds 1 tonne of fish per 1 l / s water intake. 4: Operat wodnoprawny (water elaboration) 5: Pozwolenie wodnoprawne (water permit) 6: Pozwolenie na budowę (Construction Permit) 7: Numer weterynaryjny (veterinary number) If the expansion needs the construction changes in the trout farm (as an example of an intensive farming facilities) – it needs “building permission” (Pozwolenie budowlane [57]). If the expansion has a cararter of maintenance a “building notice” (Zgłoszenie budowlane) may be enough. If there are changes in water use (obtaining water or discharge of water) then you need Water-Law permission to be changed or given a new one. If the expansion is taking new area, the Water-Law Permission to obtain may require an EIA to be made.
c. What permission(s) is/are needed to OBTAIN the license to establish a NEW trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	As above + obligatory Environmental Impact (EIA: always when building intensive farm. EIA: traditional pond farm; when the farm is to be located in nature protection area/habitat area). Building permission [57] Water-Law Permission.
d. Who can apply for such a permission (e.g. farm owner, producer association)?	Anyone can apply for it – Neutral person or legal entity, farm owner, producer association, who is running the production. The Building permission gets the investor- the owner or the one who is leasing the ground. The Water-Law Permission: intensive farming (e.g. trout) – the permission is attached to the person running the farm, with pond farm – the Water-Law Permission is attached to the pond area.
e. What qualification is needed to apply (e.g. work experience as farmer, relevant degree or diploma)?	It is not regulated.
f. How long is a permission valid?	Maximum 10 years. After 10 years the whole procedure needs to be repeated

g. How frequently do you have to re-apply?	You have to start the preparations to apply for a new Water-Law permission at least a year before the end of the existing decision.
h. Is there a difference between "old" licenses and new licenses (e.g. license stemming from before 1992, Foundation of EU)?	Yes, longer period of water permit was possible and greater fork relating to the parameters of post-production water even if we give better quality water than we took. Due to permission's validity – all permissions now based on Water Law Act of 2001 [54] - and there is a process of implementation of the Water Directive in Poland. In many places the Water-Law Permissions are being validated and there is a change in the amount of water disposable (less water is available for water users). The construction of the license (permission) is not changed basically. In many cases there are Instruction for water use in the river… introduced.
i. If there are such "old" licenses, what are the main practical differences to new licenses?	Amount of water available for aquaculture.
j. What kind of permission do you have for your farm?	NA
2.2. Legal framework	
a. Which laws (laws/departmental orders/ statutory instruments/directives/guidance and/or other forms of public regulations) are applied to regulate the permission process (see 2.1)? Please indicate if the laws are specific for aquaculture (A) or of a more general nature (G). Please give full name (in national language and English translation if possible) and link to website (if applicable).	Prawo wodne – Water Law Act [54] Prawo ochrony środowiska – Environmental Protection Law [55] Rybactwie śródlądowym – Inland Fisheries Law [56] Prawo budowlane – Building Law [57] Szereg przepisów weterynaryjnych – veterinary directives pack
b. On which regional level(s) are these laws effective (e.g. whole country, state, region, municipality)?	Whole country. Additionally, the Regional Water Management Bodies (Regionalny Zarząd Gospodarki Wodnej) is giving out regional acts, also those, in which they introduce new methods of calculating the disposable water for certain river.
c. How frequently are the relevant laws changed?	Constantly. The new change of Water Law is being prepared.
d. When was the last major / relevant change in the laws, concerning aquaculture, that you can remember?	1997 – Veterinary Law 2001/ now – Water Law 2014 – Water Framework Directive
e. Was this change directly related to an election or a new political party taking over the government?	Rather not
f. What was the motivation for this change in the laws?	Harmonize national laws with the EU acquis, elimination of administrative barriers/increase influence of administration

g. What was your opinion on the necessity / meaningfulness of this change?	Changes are different than expected. Irrelevant, minor things are being changed along with regulations that work well, while real problems are not addressed. Regarding veterinary law – it brings order in fish trading and transparency, but some regulations are sometimes interpreted differently by the regional veterinarians and restricts some elements of farming. Regarding environmental law - more administrative barriers.
2.3. Permitting authority	
a. Where do you have to apply? Please give full affiliation of the MAIN permission granting authority and link to website (if applicable).	Starostwo Powiatowe - District Office of Department of Agriculture, Forestry and Environment (or relevant, the internal structure of this authority may slightly vary) is giving the Water-Law Permissions: with jurisdiction over the place of establishment of fish farm If building/rebuilding the trout farm, the Regional Water Management Body (Regionalny Zarząd Gospodarki Wodnej - RZGW) decides if the EIA is needed.
b. Please indicate the geographic coverage of the authority's responsibility (e.g. for the whole country, federal state, county, municipality, city).	Starostwo Powiatowe – district level. There are 379 districts (powiad) in Poland (Wiki, https://en.wikipedia.org/wiki/Powiat Regional Water Management Board (Regionalny Zarząd Gospodarki Wodnej, RZGW) –Poland is divided between 7 of these regional bodies. http://www.kzgw.gov.pl/pl/Regionalne-Zarzady-Gospodarki-Wodnej.html
c. Which further authorities are involved in the process? Please give affiliations.	Municipality authority Regionalna Dyrekcja Ochrony Środowiska (RDOS)- Regional Directorate for Environmental Protection. There are 16 of these in Poland under the supervision of the general directorate (GDOS, http://www.gdos.gov.pl/). Zarząd Melioracji i Urządzeń Wodnych (ZMiUW) (Land Improvement and Water Facilities Management) ochrona środowiska (State Inspection of Environmental Protection). If you don't agree with the decision given by the Starostwo Powiatowe (county), you can make an appeal to the RZGW
d. Is there any mandatory third party involvement in the application process (e.g. research institutes, state agencies, third party experts; e.g. for statements, review of application)?	An expert has to prepare documents (so called Operat wodnoprawny – a document describing the planned investments, showing water resources and analysing the current situation in the river). If the water is to be taken from underground, there has to be hydrologic expertise. If there are other users of water /river, there must be the "Instruction of water use" prepared. Water companies, neighbours, managers of fishing districts of the region must be involved.

2.4. Application process to achieve production permit	
a. Is there more than one application necessary to MAINTAIN a license?	So far there is no “maintaining” the permission. When current permission is to be over, you have to apply for a new one, it is not prolonging, it is applying for new one every time.
b. Is there more than one application necessary to OBTAIN a NEW license?	Proceedings on four different levels
c. Is there more than one application necessary to OBTAIN an EXPANSION of an existing license?	it requires obtaining a new permission.
d. Can you draw a (generic) flow-diagram for the license process, beginning with the preparation of the application until the final decision, including all parties involved and the main milestones (see example in Appendix page 180)?	Municipal authority + environmental conditions (different parties) > Municipal authority – application for land development and management conditions > application for a water permit + Environmental Impact Assessment > application for construction permit
e. Are there templates or guidelines available for the application? Please provide reference / source.	Legal acts – major differences in interpretation between local authorities. Relevant local authorities provide descriptions of application process.
f. In which language can you / do you have to apply?	Polish
g. How much does the application cost (e.g. administrative fee for obtaining the license)?	217 PLN for the application (administrative fee). Costs of preparing documentation can vary due to the process of applying for a permit, but often 15.000 - 30.000 €
h. Is there a fee for the license as such (e.g. fee per production volume/area, etc.; apart from any administrative cost)?	Currently not, but it is planned to introduce this type of charge
i. What is the official expected time to process the application (until decision – weeks? months? Or years?)?	from bringing the application (with documents) to the authority until receiving the decision; normally max 2 months, but may take 3 - 6 months. Preparation to complete the documentation (with the decision on building conditions) may take even a year or more.
j. How long does it actually take to get a license (e.g. based on the average of the last application process you know)?	Up to 12 months, EIA it is 3 – 6 months
k. What are the main causes for delays in the process (e.g. expert & public hearings, appeals, environmental impact assessments (EIA), law suits, etc.)?	Administrative procedures. Appeals and EIA, when needed.
l. Is there a legally binding maximum time the authorities can work on the application before giving a decision?	Max 90 days + 30 in exceptional cases (if no appeals)

m. What documentation is needed for the application (e.g. map, GPS-location, description of facility, technical sketches, technical leaflets)? (See also questions to the use of specific technologies in section 2 and 3, below)	The documentation – Operat wodnoprawny consists from 2 parts: 1. descriptive part: -localization of the investment -state of the water situation -influence of the investment on the ground and surface water -other users of the water/river -description of the investment -legal state of the place where investment is planned -relations with other users of the water/river -what kind of measuring equipment will be used to monitor the amount of water taken. -description of how much water it is planned to be taken, via what technical equipment it will be taken (a dam, etc.) -technical description of the whole investment, -characterisation of the water discharge: amount of sewage, chemical composition of the sewage, plan of monitoring the sewage composition, description of methods to reduce the discharge load, information on how the withdrawn sewage will be used, -information of the place is not protected under any form of environmental protection. 2. graphical part: -plan of the water devices and its influence on the surface waters – on a map -longitudinal and cross-sections of the water devices and the river basin - technological and functional scheme of the investment
n. If there is more than one application involved in the process, how do the applications interact?	Numerous applications prolong the process. In case of new and in case of construction change of the existing installation you need the Building permission. To obtain building permission you need to have Water-Law Permission.
o. Is there one application that is superior to the others?	actually no, you need both to start investment.
p. Are the application processes completely separated from each other?	Yes, one process suspends the other
q. How do the different authorities interact with each other (e.g. based on a formalized procedure)?	Contact between authorities is formalized (they do not interact directly) and prolongs the process.
r. What happens if one application is rejected?	The whole process is halted, there is no permission
s. What kind of written “proof” (e.g. verdict, official letter, certificate) do you receive in the end?	Administrative decision
t. What is easier? Apply for a renewal of an existing license or apply for a completely new license?	The same – renewal doesn’t require first three stages. Formally there is no prolonging/renewal – only a new permit, but as a new potential user of the water it is more difficult, because the existing users may oppose, make problems and block the process.
u. What kind of application process did you have to go through?	NA
v. Can you give us a copy of this document for your farm? (permit/license to produce and/or water abstraction permit/license).	NA

w. What are the possibilities to complain or appeal a decision of refusal?	Appeal to superior organ – Two-instance procedure to administrative court If you don't agree with the decision given by the Starostwo Powiatowe (district), you can make an appeal to the RZGW
x. Does the fish farmer have to appeal himself or will the farmer's organization do it/assist the farmer?	Has to be done personally, but can get support from organizations / experts
y. Will an appeal be dealt with by public authorities directly or will it be necessary to start private proceedings?	First instance – administrative, next two instances in administrative court which is easier than in private proceedings
z. Can the expenses for an appeal be estimated?	Administrative fees, regardless from investment's scale
aa. What is he expected time span for the appeal to be accomplished?	1.: 30 days, 2. administrative court: 60 days, 3. Supreme Administrative Court: 12 months. In reality – 3-4 years

6.1.4.2 RELEVANT RESTRICTIONS IN RELATION TO PERMISSION / LICENSE

Table 17 Questionnaire. POLAND. Section 3.

3.1. Size	
a. Is there a production size limit for the permission (e.g. maximum production volume, feed usage, water usage, area)?	The Water-Law Permission limits the amount of water taken from the river or from underground – usually in litres per second or in case of carp ponds – in m^3 in month/year AND the discharge of sludge (that is how formally it is regulated). So, it limits how much water you can take and how much you have to give back and how/where. There can be additional restrictions/ regulations in that decisions, e.g. maintaining the river or servicing the channel that brings water from the river to the farm, etc.
b. What is the maximum size of your production you are allowed to have?	This is not specified but it depends on water quantity, we care about the welfare of fish and water quality
c. Are there different requirements for different sizes of production (e.g. full EIA for a large farm, less detailed investigation for a small farm)?	yes, EIA is required if the farm is localized in the protected area and when the production exceeds 1 ton from 1 litre/s, but also if the production is lower but the authority decides that from some other reasons it is needed.
d. What are the thresholds, if any?	Obligatory 1000kg from every 1l/sec, or if placed in an area within any form of protected environment (Natura 2000)
e. In case, permissions are limited by production size, can you apply for more than one permission?	Production size isn't limited
f. What are the conditions for doing so?	
3.2. Facility type	
a. Are there different requirements for different facility types (e.g. earthen ponds, concrete ponds/raceways, indoor/outdoor, flow-through, partly-recirculated, located in country-side or in an industrial area)?	earthen ponds – usually no need for EIA, building permission fairly easy to receive. intensive farming – more complicated Water-Law conditions, especially in terms of discharge, water quality monitoring, water purification, strict conditions of post-production water quality

b. Is there any kind of production facility that would be generally considered IMPOSSIBLE to get a permission for (e.g. see above)?	Generally, it is not easy to obtain the Water-Law Permission even for a "regular" type of farm.
3.3. Water	
a. How much INTAKE water are you allowed to use?	NA
b. What OUTLET water composition do you have to fulfil?	NA
c. Is there an ABSOLUTE (irrespective of production volume) limitation on the intake / outlet water QUANTITY (e.g. expressed as litre per second or percentage of a river flow)?	It is in the process of being changed. There is a limitation depending on low water levels/flow in rivers (SNQ). At present it is set at 50% SNQ [= ½Qmm, ed.]. The upcoming changes that will prohibit water abstraction during low water levels. It will be a serious threat for farms renewing licenses.
d. Is there a RELATIVE (in relation to production volume) limitation on intake / outlet water QUANTITY (e.g. volume per kg produced, volume per kg feed used)?	No, water quality only
e. Are there ABSOLUTE requirements for the COMPOSITION of outlet water (e.g. maximum content of nitrogen, maximum suspended solids)?	No
f. Are there RELATIVE requirements for the COMPOSITION of outlet water (e.g. nitrogen discharge per kg produced)?	Yes, there is a set of water quality measures – also depending on quality of intake water - it regulates what max load you can add to the water without paying charges.
g. Are there RELATIVE or ABSOLUTE requirements for the COMPOSITION of outlet water in relation to the flow (e.g. e.g. nitrogen discharge per litre outlet flow and/or related to concentration in the inlet flow – in other words: additive load per water volume)?	Yes, limited and also depending on quality of intake water. (Ministry of Environment, Law on effluent water and harmful substances [58]; Annex 11) provides water quality thresholds for salmonid farm effluent water. Max allowable load of substances in the waters used for salmonids production or in farms of production type similar to salmonids production : BOD: 3 mg O_2/l COD: 7 mg O_2/l Total suspended solid matter: 6 mg/l Total nitrogen: 1 mg N/l Total Phosphorus: 0,1 mg P/l
h. Is there a fee/cost for using/abstracting the water from the river/the well? If so, what are the cost/fee?	So far there is no fee for abstraction of water from rivers. A fee can appear when you exceed the production limit: Carp ponds: 1500kg of biomass growth per hectare; Salmonids: when you exceed the substances load. it is planned in the new Water Law to charge aquaculture and introduce a kind of paid licensing.
i. Is any or all of the above restrictions limiting the production on your site (e.g. when your river / well has more capacity than you actually are allowed to use)?	It is a subject of legal changes. For the moment: Limits of volume of water intake, water quality monitoring, and all above mentioned limits in the permissions. If you want to increase production you are also obligated to provide an infrastructure for water purification
3.4. Sludge	
a. Is it mandatory to collect and remove sludge?	yes, in salmonids production it is necessary to keep the water quality within above mentioned limits (because the charges when you exceed the limits of max load are severe)

b. Is there an ABSOLUTE limitation on sludge quantity (e.g. tons of dry matter per year)?	No
c. Is there a RELATIVE limitation on sludge quantity (e.g. kg sludge per kg produced)?	No
d. What further usages of sludge are allowed (e.g. as fertilizer, biogas, composting, dumping)?	Permission is needed for composting and biogas. As fertilizer, examination/analysis of the sludge needed.
e. Is your permission / license linked to a sludge quota (e.g. maximum allowable quantity per year)?	No
3.5. Feed	
a. Does your permission / license specify any limitation on the feed you use (e.g. brand, country of origin)?	No
b. Is there any specified requirement for the feed components, composition (e.g. feed specific N-, P-content, N-, P-discharge, faecal stability, digestibility)?	Linked with regulations of feed market. If you would like to produce organic product, certificated production
c. Is your permission / license linked to a feed quota (e.g. maximum allowable feed quantity per year)?	No
3.6. Land / area usage	
a. Are you the owner of the land / area that you are using for production?	Yes
b. If you are not the owner, which legal status / agreement do you have with the actual owner (e.g. a lease contract)?	Part of the carp ponds area used to be leased from the state, now it is ownership
c. How does this ownership-status affect your rights in relation to production permission / licensing?	Less complicated procedure
d. Is there an ABSOLUTE (irrespective of production volume) limitation on the area usage (e.g. expressed as ha water surface area)?	No
e. Is there a RELATIVE (in relation to production volume) limitation on the area usage (e.g. water surface area per kg produced, area per kg feed used)?	For carp – 1500kg of biomass growth per ha – actually it is not a limit but over that amount, you have to pay for water use;
f. Do you have a requirement to work in different intensity levels on certain areas of your property (e.g. leaving one pond untouched as compensation area for producing in another pond)?	No
g. What are typical spatial planning conflicts with habitats, protected areas? Please give an example.	Restrictions for farming on areas with environmental protection/Natura 2000, stereotypes regarding farms' environmental impact - e.g. cormorants, beavers, lots of conflicts with anglers, who don't like fish farms as they limit the access to the river in some cases
h. How close is/are your farm(s) located to a protected environment (e.g. Natura2000, etc.)?	Farm is an enclave surrounded by Natura2000 area, National parks
i. How does the site location affect the permission process (e.g. when located in or close to a Natura2000 site)? Please give an example.	Habitats in a distance of 20 -30 km impose an obligatory EIA in case of changes – higher documentation costs. Placing buildings of certain height is limited, EIA is needed when placing new farm (most of existing ones was built before N2000 site was established)
j. Are there any areas that are PRECLUDED from trout farming (i.e. where the government really wants to have no farms)?	There are local bans to establish farms is certain areas.

k. Are there any areas that are PRIVILEGED for trout farming (i.e. where the government preferably wants to have farms)?	No
l. Does your fish farming permission / license regulate your property usage (e.g. in terms of percentage of land that must not be built on)?	No
3.7. Predators and other wildlife	
a. What "general" measures are you ALWAYS allowed to use against fish-eating predators (birds, otters, etc.) (e.g. noise deflection)?	Deflection, but only for not protected species - no harm is generally allowed, special permission needed for that. You can build a fence around the farm or cover the ponds with anti-bird's net. It happens in case of trout farms, there it is possible because it is a relatively small area.
b. What "special" measures are you ONLY allowed to use against fish-eating predators (birds, otters, etc.) when you are in possession of a special license or in dedicated areas or times of the year (e.g. gun shooting only with hunters' license)?	Gun shooting – after acquiring a license for a period of time and a number of individuals
c. What measures are you NOT allowed to use against fish-eating predators (birds, otters, etc.)?	Traps, poison
d. Which of the above mentioned measures to use against fish-eating predators are most frequently used in your country?	Deflection, shooting
e. Is there any practical experience / scientific documentation or other source of evidence for the effectiveness of these measures in your country? Please provide source name and web-link if applicable.	Strategy of Cormorants population in Poland [59] Plan of beavers protection in Poland [60]
f. What other "problematic" interactions with other types of wildlife (other animals, plants, etc.) do occur?	Destruction of levees by beavers fish eaters: cormorants, grey heron, white heron, mink, otter.
g. How are they "typically" regulated? Please provide reference and web-link, if applicable.	You can apply to the Regional Directorate of Environmental Protection for a permission specifying how and when you can scare the certain species and how many, when and by whom can be shot.
3.8. Energy	
a. Does your permission impose any requirements / regulations on your energy consumption (e.g. maximum kWh use or kWh per kg produce)?	No, the public power-grid is limiting the energy use. No relation to production volume.
b. Are there any requirements to maximum amount or demands on reduction of energy used – when OBTAINING a MAINTENANCE license (if this is applicable in your country)? (e.g. per kilo produce, percent reduction to comply with - or otherwise?)	No
c. Are there any requirements to maximum amount of energy used - when OBTAINING a NEW LICENSE? (e.g. per kilo produce or otherwise?)	No
d. Does your farm have a connection to the public electricity grid or do you use other means to generate electricity? Please specify (e.g. Diesel generator, solar panels, proportion of renewable energy).	Farm is connected to the public electricity gird but in case of lack of energy we use diesel generator
e. Does your permission create any incentives / benefits to safe energy in production or to use renewable energy sources e.g. windmill, solar (Renewable energy sources is a must in organic production)	NO, but Energy=costs, it is always an incentive to reduce energy use. In EMFF 2014-2020 there is a financing of renewable energy sources, 50% of costs refund.

3.9. Interactions with other stakeholders	
a. What are "typical" regulations that affect your interaction with other stakeholders, like: (Please give examples and references, if applicable)	On every level there is obligation to consult neighbours and other users of watercourse
○ Recreational anglers	access to water – you have to leave minimum of 1,5 m wide path along the river
○ Migrating fish organizations, conservation organizations	in most cases there is a must to build a fish pass when building/ rebuilding a dam
○ Environmental NGOs	no
○ Tourists and tourism industry	no
○ Agriculture, farmers	
○ Water energy, power dam operators	it is in many cases conflicting with the water use for fish farming.
○ Others (please specify)	
3.10. Veterinary and animal welfare affairs	
a. How frequently are you interacting with your veterinarian?	Depending on the needs, once a month
b. What are the most common reasons for you to work with a veterinarian?	Fish welfare, prophylactic, supplementation,
c. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Not needed. No veterinary and animal welfare requirements (e.g. maximum stocking densities) are specified in permission Only when building a new farm and then yearly controls
d. What kind of veterinary approval is required to obtain the permission?	There is always an on-site control visit of the veterinary service. Veterinary number.
3.11. Medicines & chemicals	
a. Are medicines only available after veterinary inspection and prescription?	Prescription only, veterinarian's decision
b. Are you allowed to store veterinary prescribed medicines at your farm?	Yes, in proper conditions
c. If yes to b: Under which conditions are you allowed to store medicines – and in which amount?	Depending on prescription, stored according to manufacturer's recommendation
d. Is it mandatory to register the medicines in storage?	Yes
e. Are you allowed to apply the stored medicines at your own or only under veterinary instruction?	Only according to veterinary instruction
f. Is it mandatory to register the use of chemicals and medicines? If yes: How do you register?	Yes, Karta Leczenia (treatments card)
g. What kind of medicines & chemicals are you allowed to use (e.g. formalin/ formaldehyde, salt, hydrogen peroxide)?	There is a list of chemical agents and medicines – which is being followed by veterinarians. The list becomes gradually shorter. Normally: formalin, salt, CaCO3, hydrogen peroxide
h. What kind of medicines & chemicals are you NOT allowed to use that you historically did use (e.g. malachite green)?	Malachite green, copper sulphate, formalin (restricted use), antibiotics
i. Which of these substances do you use regularly to treat your fish?	Peracetic acid, formalin, salt, CaCO3, hydrogen peroxide (disinfection), medicines where necessary.
j. Please list the medication you normally use (based on a veterinary prescription).	Peracetic acid, formalin, salt, CaCO3, hydrogen peroxide (disinfection), medicines where necessary.
k. Do you use vaccinated fish in your production?	Yes
l. Do you vaccinate yourself or do you buy already vaccinated stocking material?	Yes, but normally buy already vaccinated stocking material
m. Which of these substances do you use regularly for other purposes (e.g. disinfection between production cycles, disinfection of equipment)?	formalin, salt, $CaCO_3$, hydrogen peroxide (disinfection) – both during and after every production cycle.

n. What are relevant limitations for the use of these substances (e.g. maximum allowable use of a disinfectant per production/per water-volume/per kg-fish)?	No regulation giving limitations apart from Formalin – mustn't escape into environment. For most substances, the amounts used are negligible in relation of water volume used for production (dilution)
o. What special regulation exists for effluent water containing residuals from medicinal or chemical treatment (e.g. maximum residual concentration)?	Not applicable. [if such residues are detected (e.g. by the environment protection services), there would be decision for utilising it in a certain way.]

6.1.4.3 SELF-MONITORING AND REPORTING REQUIREMENTS ON FARMS

Table 18 Questionnaire. POLAND. Section 5.

5.1. Environmental self-monitoring	
a. What information (in relation to the above mentioned restrictions) do you routinely monitor and document yourself as a farmer? Please indicate these metrics here, unless you haven't already done so in the beginning of the questionnaire (see 1.)	
○ Production size, i.e. quantity of fish produced	Yes, of course monitored but not because it is required by BAT/BEP, but because of the Water Law (described above) It is required to document the production in so called "pond books".
○ Use of different facilities (e.g. ponds or raceways)	as above – the use of ponds is described in "pond books"
○ Water (i.e. quantity and quality parameters)	Yes, as mentioned in the table of max allowable substances load – these substances must be monitored 4 times a year in the first 4 years of farm operation and, if the levels of max load are not exceeded even once, you can continue with twice a year monitoring. You send the results of water tests to relevant environment services. These services examine the water themselves during the year as a control.
○ Sludge	No
○ Feed	No
○ Land / area usage (additional to facility)	No
○ Energy	No
○ Medicines, chemicals	"pond books" plus documentation related to GMP/GHP – Veterinary part (food safety)
b. How do you monitor and document (writing/filling out tables/formulas in paper, electronically using software on a computer)?	Both, GMP/GHP and vet documents in paper, "pond books" – computer program
c. Are there regulations that specify how to do the self-monitoring?	Yes, Księga Stawowa (pond book)
d. Is there specific equipment required to monitor (e.g. special types of probes to be used for water quality)?	Certified third parties (Accredited laboratories)
e. When, how and by whom are your self-monitoring documents checked?	Veterinarian service check it, minimum twice a year. Environmental services once-twice a year
f. How long do you need to store them?	Minimum 5 years
g. Can you provide us with a (blank) copy of your self-monitoring documents as an example?	Yes
h. What happen if your self-control measures are out of bounce/beyond the limits of your license?	Charges + fines exceeding real value of a farm

i. What are the consequences….?	depends what is the issue about but it may result in cancelling the water-law permission (if more water that permitted is taken e.g.), financial fine or a decision to change/improve is given.
5.2. Environmental controls	
a. Who conducts environmental controls (e.g. authority, delegated institution or the farmer himself)?	Regional Inspectorate of Environment Protection (Wojewódzki Inspektorat Ochrony Środowiska - WIOŚ) and Regional Directorate of Environmental Protection (Regionalna Dyrekcja Ochrony Środowiska – RDOŚ), Regional Administration of Melioration and water devices (Wojewódzki Zarząd Melioracji i Urządzeń Wodnych – WZMiUW)
b. How frequently are you controlled?	Irregularly, every 5 years. Once in few years Sometimes once, twice a year
c. Are the controls announced or spontaneous?	Both
d. What kind of documentation is required?	Comprehensive control, extensive documentation WIOŚ: all water tests results, all obligatory surveys and all documents the surveys are based on. It is not only about the water, it is about the air pollution (eg heating, machines, cars), sewage, trash, thermic pollution, noise, etc. RDOŚ: protected species, protected areas, fish-eating species and losses done by them, etc. WZMiUW: water levels in ponds, water-law permissions (amount of water taken, etc.), technical state of dams, etc.
e. What does the controlled check (e.g. environmental index in the receiving water-body (flora & fauna indexes), other types of measuring possible impacts)?	All water tests result, all obligatory surveys and all documents the surveys are based on, protected species, protected areas, fish-eating species and losses done by them, water levels in ponds, water-law permissions (amount of water taken, etc.), technical state of dams – comprehensive control

6.1.4.4 PERFORMANCE OF PERMISSION

In the days before editorial finalisation of this report (mid April 2016), we received notice from our Polish interview partners, that “major changes” in the regulatory framework of the Polish aquaculture sector are going to be decided in short due. The Polish government, here: Ministry of Environment (Ministerstwo Środowiska, www.mos.gov.pl), apparently announced to introduce a general fee on water abstraction and discharge and the requirement for technically demanding water flow measurements. In the following table, we cite the appeal of the organization “Pan Karp” dated on 26.04.2016 [61].

Polish original text	Google translation
Polska akwakultura zagrożona Apel do wszystkich uczestników procesu legislacji nowej ustawy Prawo Wodne Tradycyjne stawy hodowlane istnieją w Polsce nieomal od początku naszej państwowości. W tym czasie przechodziły różne koleje losu, ale dzięki pokoleniowej pracy rybaków i mądrej polityce państwa stanowiły przez stulecia przyrodnicze enklawy i źródło	Polish aquaculture threatened Appeal to all participants in the process of legislation of the new Water Law Traditional breeding ponds exist in Poland, almost from the beginning of our statehood. At the time, they underwent various vicissitudes, but thanks to the work of generations of fishermen and wise state policy were for centuries the natural enclave and a

cenionych polskich karpi.	source of valued Polish carp.
Dzisiaj ich los jest zagrożony poprzez wprowadzenie do niespójnego i pospiesznie procedowanego projektu ustawy Prawo Wodne opłat za pobór wód na potrzeby chowu lub hodowli ryb.	Today, their fate is threatened by the introduction of the inconsistent and hastily procedowanego draft Water Law charges for water consumption for the purpose of farming or fish farming.
Autorem projektu ustawy jest Ministerstwo Środowiska, które w myśl motta zamieszczonego na swojej głównej stronie www. mos.gov.pl "prowadzi politykę zrównoważonego rozwoju z zachowaniem ojczystych zasobów przyrodniczych i polskiego krajobrazu."	The author of the bill is the Ministry of Environment, which according to the motto stated on its main website. mos.gov.pl "a policy of sustainable development with preserving natural resources and native Polish landscape."
Pracownicy Ministerstwa Środowiska doskonale wiedzą, jak cenne zasoby przyrodnicze posiadają tradycyjne, ziemne stawy hodowlane. Wiedzą, że nie zużywamy wody, a jedynie używamy ją, oddając środowisku w niepogorszonym stanie. Wiedzą także, że te przyrodnicze zasoby istnieją dzięki prowadzonym hodowlom ryb, a te będą funkcjonowały tylko wówczas, gdy rybacy będą widzieli w ich prowadzeniu przynajmniej minimalny sens ekonomiczny. Tym bardziej jesteśmy zaskoczeni i zdziwieni, że Ministerstwo Środowiska posiadając tę wiedzę, próbuje nagle wprowadzić opłaty za pobór wód na potrzeby rybackich hodowli, co doprowadzi do degradacji gospodarki rybackiej, a w konsekwencji do degradacji przyrodniczych zasobów w tym Natury 2000. Nie jest nadużyciem stwierdzenie, że bez rybackiego utrzymania skomplikowanych systemów wodnych, tysięcy mnichów, jazów, zastawek i doprowadzalników wody, na opuszczonych stawach nastąpi ekologiczna klęska.	Employees of the Ministry of Environment know very well how valuable natural resources have traditional, earth ponds. They know that they do not consume water and only use it, giving the environment in a non-deteriorated condition. They also know that these natural resources are a result of ongoing fish breeding farms, and these will operate only when the fishermen will see their conduct at least a minimum economic sense. The more we are amazed and surprised that the Ministry of the Environment having this knowledge, trying to suddenly introduce fees for water consumption for the needs of the fishing farms, which will lead to the degradation of fisheries management, and consequently to the degradation of natural resources in the Natura 2000 is not to assert that no fishing maintain complex water systems, thousands of monks, weirs, valves and doprowadzalników water, abandoned ponds will be ecological disaster.
Dlatego też, apelujemy do autorów projektu ustawy Prawo Wodne, o usuniecie zapisów wprowadzających opłaty za pobór i odprowadzanie wód na potrzeby chowu lub hodowli ryb i zapisów wprowadzających obowiązek montowania zawodnych w naszych warunkach(śryz, liście itp.), niepraktycznych i bardzo drogich nowych urządzeń służących do pomiaru ilości pobieranych oraz odprowadzanych wód (średnio kilkunastu punktów pomiarowych w każdym obiekcie hodowli ryb). Dotychczasowy pomiar przepływów przelewy prostokątne na mnichach dopływowych i odpływowych jest zgodny z naszymi pozwoleniami wodno prawnymi i praktyczny w zastosowaniu.	Therefore, we appeal to the authors of the draft Water Law, by removing the provisions introducing charges for collecting and draining water for the purpose of breeding or rearing of fish and records introducing mandatory installation unreliable in our conditions (frazil ice, leaves etc.), Impractical and very expensive new equipment to measure the amount charged and discharged waters (average of several measurement points in each object fish farming). The existing flow measurement transfers Rectangle monks inflow and outflow is in line with our water permits legal and practical in application.
Zwracamy się do naszego branżowego Ministerstwa Gospodarki Morskiej i Żeglugi Śródlądowej które wielokrotnie podzielało nasze stanowisko, zwracamy się do organizacji rybackich, ekologicznych, ornitologicznych i przyrodniczych, do rybackiego świata nauki, do lokalnych grup rybackich, do propagatorów zdrowej żywności, do mediów, do wszystkich dla których polskie stawy są dziedzictwem przyrodniczym i kulturowym o poparcie naszego apelu.	We turn to our industry the Ministry of Maritime and Inland Navigation which have repeatedly echoed our position, we turn to fishing organizations, ecological, ornithological and natural, to the fishing world of science, local fishing groups, the proponents of healthy food, to the media, to all the Polish joints which are the natural and cultural heritage to support this appeal.

Poparcie naszego apelu prosimy kierować bezpośrednio do Ministerstwa Środowiska e-mail: info@mos.gov.pl lub na nasz adres e-mail: biuro@swietokrzyskikarp.pl Rytwiany 21.04.2016r. Lokalna Grupa Rybacka Świętokrzyski Karp Towarzystwo Promocji Ryb - Pan Karp	Support this appeal, please contact directly to the Ministry of Environment E-mail: info@mos.gov.pl or to our e-mail: biuro@swietokrzyskikarp.pl Rytwiany 21.04.2016 Lokalna Grupa Rybacka Świętokrzyski Karp Towarzystwo Promocji Ryb - Pan Karp

Table 19 Questionnaire. POLAND. Section 6.

6.1. Your experience with permission	
a. Did you ever have to apply for a license to MAINTAIN, OBTAIN NEW or OBTAIN EXPANSION license?	Yes
b. How long did it take in your case to get the license?	For preparation – 1 year From application till decision – 2 months
c. What negative experiences did you make?	Different interpretations of authorities No reliable data of water levels in the river. The authority gave permission to too many users (last one who got it built a small water power plant – conflicts about the water)
d. What positive experiences did you make?	all water users in this river got their permissions that end all in the same time, there is an instruction for water use,
6.2. In your country in general	
a. How many NEW production licenses have been granted in the last 1, 5, 10 years?	No data, no statistics! (possible 20-50?)
b. How many existing production licenses have been CHANGED in the last 1, 5, 10 years?	20-50?? farms are growing but also get more technically advanced
c. In how many cases was the production volume increased?	Most of them (?)
d. What was the success rate of applications in the last 1, 5, 10 years?	No data (guess: 80% ??)

6.1.5 UNITED KINGDOM

The legal system in respect to obtaining a permission to produce portion-sized trout in the United Kingdom, is governed by the structural differences between England, Wales, Northern Ireland and Scotland. For the sake of simplicity, we will try to highlight the major differences between England and Scotland. Our interview partners were stemming from both regions, even though one of the Scottish partners represented a larger company, producing mainly large sea trout.

Scotland has put aquaculture higher up on the agenda for business and growth, mostly rooting its success story in the Atlantic salmon sector. Apparently, this had some positive effects on the structural maturity of the whole sector, including the authorities that pertain to the permission process. In Scotland we find probably the best developed and documented work flow for this process, which does not imply that it is any easier or less complicated in its extent. The level of proficiency is just higher. Because of the higher relevance of Atlantic salmon production and its sea cage production (and land-based smolt operations), the "traditional" case of flow-through trout production falls a bit aside and struggles with its specific land-locked problems, e.g. access to building permission, which is governed by those authorities which did not primarily benefit from the growing proficiency of other authorities dealing with salmon. In England, the traditional trout production sector, i.e. flow-through systems attached to a river, has only benefited to a minor extend from this positive development of the sector in the Northern part of the United Kingdom. Not surprisingly, the positive experiences with authorities and regulations were attested to those entities that were either directly adapted from Scotland and/or those who are applicable for both (e.g. veterinary health plans).

In both regions, third party certification is a driving force to utilise BAT/BEP and, as a consequence, also to provide adequate documentation. This has led to a situation, were farmers have to handle a lot of environmental self-monitoring, technical and animal health documentation for the audit scheme, which they then can "easily" supply also for the authorities. This has probably lightened up a bit the otherwise difficult relation between farmers and regulatory authorities, but it is certainly not a relief in terms of complexity of a fish farmers job profile in England (and Scotland).

6.1.5.1 OBTAINING PERMISSION / LICENSE FOR TROUT PRODUCTION

Very recently, England has launched an "Aquaculture Regulatory Toolbox" [62] which at this point in time provides very concise documents describing i.a. the different production sectors and a list of all associated legal frameworks. The website was launched a week before the editorial deadline of this report, hence we only quickly reference it here and place the documents in the attached literature database. The content of the documents is produced by CEFAS and approved by DEFRA. Most relevant for the scope of this paragraph is the respective document freshwater production in flow-through and static systems [63].

Table 20 United Kingdom. DG MARE workshop table.

	Description of laws and legal areas relevant for trout production in United Kingdom (quoted from DG MARE workshop material, Good practices in administrative simplification for the promotion of sustainable aquaculture – 18-19 November 2015). All credit to the author.
	ENG, SCO, WAL: Planning permission from the local authority ENG: Marine Development/Construction license from the Marine Management Organisation WAL: Marine Licence for construction on the sea bed NI: Planning permission from the Department of the Environment Planning Service (land based sites only) A local authority (or planning authority) is responsible for determining planning applications for new finfish and shellfish farms or modifications to existing farms. Fees apply. Statutory consultation, right of appeal. 2 months for assessment (4 months if EIA) A developer must apply for and obtain planning permission before developing a sit, whether this is a water based structure like a pen group, or a tank or pond based system on land. The EIA Regulations apply to fish farm development therefore a developer must obtain a 'Screening Opinion' from the Local Authority to see if an Environmental Statement will be required. If required, then the LA must consider the environmental impacts before determining the planning application. Planning legislation requires the LA to determine planning applications in accordance the Development Plan unless material consideration indicates otherwise. Wales - Marine Licences for construction on the sea bed are granted by Natural Resources Wales (NRW) SCOTLAND: Fish farm operators require prior planning permission before undertaking any activities which may damage the water environment, and local Authorities grant planning consent for Marine and freshwater fish farms (both shellfish and finfish) under the Town and Country Planning Act 1997. When considering an application, the local authority conducts a detailed assessment of the potential impacts of the development and may request an Environmental Statement, or full Environmental Impact Assessment (EIA). Marine licences are issued by the Marine Scotland Licensing Operations Team (MS LOT). Licensable activities may include, but are not limited to the deposit of substances or objects into the sea or on to the sea bed, removal of substances or objects from the sea bed, construction, alteration and improvement works, dredging, and the deposit or use of explosives. http://www.gov.scot/Topics/marine/Licensing/marine
	ENG, SCO, WAL Lease or land use consent from The Crown Estate or other land owner NI: Proof of site ownership or lease (land based sites only) Consent in principle to the grant of a seabed lease from the Crown Estate Commissioners or other owner of the seabed (marine sites only) An operator must apply to the Crown Estate for a lease for the right to occupy the site where the foreshore/seabed is owned by the Crown Estate (or the relevant landowner if foreshore or seabed is in alternative ownership). Online application form available. No fees (there are fees thereafter on an annual basis). Planning permission is a prerequisite. Can be issued within 1 month if all info is provided in application. New lease duration: 25 years. The seabed out to 12nm is owned by the CE. SCOTLAND: Under the Land Reform (Scotland) Act 2003, everyone can exercise access rights over most land and inland water in Scotland, providing they do so responsibly. This applies to rivers, lochs, reservoirs, riverbanks, loch shores, beaches, and the coast. Operators can lease or use land with consent from The Crown Estate or other land owner.

	ENG: For shellfish not requirement for EIA. For finfish there are specific thresholds (e.g. for finfish its 10 tonnes for terrestrial and 100 tonnes for Marine). Activities would also need to comply with environmental regulations if in an area of statutory protection (such as SSSI, European Marine Site, or Marine Conservation Zone) and will need to be consented and/or assessed accordingly by the Competent Authority in question Natural England; Habitat Risk Assessments may be required depending on the location and nature of the activity in relation to the location and nature of the receiving habitat local Inshore Fisheries and Conservation Authority (IFCA) NI: environmental impact assessment under the Environmental Impact Assessment (Fish Farming in Marine Waters Regulations (Northern Ireland) 2007 (marine fin fish farms only) Competent authorities in Wales are: Welsh Government and NRW SCOTLAND: Most finfish farm planning applications require an EIA. When considering an application for a fish farm, the local authority will seek advice from Marine Scotland, SEPA, Scottish Natural Heritage, Historic Scotland, and local District Salmon Fishery Boards, on potential impacts of the development on water quality, interactions with predators, wild salmonids, species and habitats, conservation areas, landscape, marine cultural heritage, noise, and waste.
	ENG, WAL: Authorisation by the Fish Health Inspectorate under Aquatic Animal Health (England and Wales) regulations 2009 (https://www.gov.uk/fish-and-shellfish-farm-authorisation-and-registration); and the Alien and Locally Absent Species in Aquaculture (England and Wales) Regulations 2011 if applicable SCO: Authorisation by Marine Scotland under the Aquatic Animal Health (Scotland) Regulations 2009; routine inspections by the Marine Scotland Fish Health Inspectorate for conformity with all statutory requirements under the Animal Health and Welfare (Scotland) Act 2006. NI: Aquaculture Production Business authorisation under the Aquatic Animal Health Regulations (Northern Ireland) 2009 SCOTLAND: Fish health management in Scotland is undertaken by the Fish Health Inspectorate (Scotland), and its mission is to support a healthy sustainable aquaculture industry and to safeguard the health of wild fish stocks, through regulation and scientific advice backed by high quality research. It aims to prevent the introduction and spread of serious fish and shellfish diseases by providing an advice and diagnostic service to fish and shellfish farmers, District Salmon Fishery Boards, Fishery Trusts and other stakeholders. Fish Health inspectors conduct a statutory inspection and sampling programme and are appointed by the Scottish Ministers under the fish health legislation. This legislation includes: The Aquatic Animal Health (Scotland) Regulations 2009 (implementing Council Directive 2006/88/EC), The Fish Farming Businesses (Record Keeping) (Scotland) Order 2008, The Aquaculture and Fisheries (Scotland) Act 2007, amended by The Aquaculture and Fisheries (Scotland) Act 2013, Trade in Animals and Related Products (Scotland) Regulations 2012 and The Sea Fisheries (Shellfish) Act 1967. The fish health inspectorate also co-operates with the Animal and Plant Health Agency (APHA) under the Animal Health and Welfare (Scotland) Act 2006. The 2009 Regulations require authorisation of all aquaculture production businesses (APB's) prior to any farming operations being undertaken. APB's must gain individual authorisation for each site. Authorisation is granted subject to conditions such as implementation of a biosecurity plan, maintaining movement and mortality records and notification of breaches of containment. The fish health inspectorate maintains a publically available electronic register of APB's. There are no fees for authorisation and applications are processed within 90 days. Authorisations can be suspended, revoked or amended at any time
	ENG: Local authority permissions (food hygiene and safety); The Food Standards Agency (FSA) is the responsible body for maintaining and improving food safety standards in England, Wales and Northern Ireland. SCOTLAND: Food safety is the responsibility of Food Standards Scotland (FSS). For shellfish, FSS publish weekly Official Control results from the biotoxin, phytoplankton and E. coli monitoring programmes. The FSS website also details all historic shellfish monitoring results: http://www.foodstandards.gov.scot/food-safety-standards/advice-business-and-industry/shellfish/shellfish-results#sthash.IBiwa1PE.dpuf

	ENG: Abstraction licences NI: water discharge consent and abstraction licence from the Northern Ireland Environment Agency Water Management Unit Wales These licences are issued by NRW SCOTLAND: Water abstraction for any purpose in Scotland is covered by the Water Environment (Controlled Activities) Scotland) Regulations 2011 (CAR). http://www.sepa.org.uk/regulations/water/abstractions/.
	ENG: Abstraction and discharge is regulated by the Environment Agency under the Environmental permitting regulations (E&W) 2010. WAL: Consent for discharges from a fish farm, or a Marine License for discharge from a boat NI: water discharge consent and abstraction licence from the Northern Ireland Environment Agency Water Management Unit Marine Licence from the Department of the Environment Marine Division in the case of a marine fin fish farm (?) Wales - Consent for discharges is granted by NRW SCOTLAND: Regular monitoring of water quality, including discharges from fish farms, is carried out by SEPA under the Water Environment (Controlled Activities) Scotland) Regulations 2011 (CAR). The regulations cover rivers, lochs, transitional waters (estuaries), coastal waters groundwater, and groundwater/dependant wetlands. http://www.sepa.org.uk/regulations/water/ . All fish farms operators must obtain a CAR license; which sets limits for discharges in its consent conditions. SEPA carries out routine inspections for conformity to all environmental regulation, including the provisions of the Water Framework Directive and related permissions and controls. The licensing regime is risk based with tiers reflecting the potential impact of different activities. Most marine fish farms fall within the highest tier requiring a complex licence. Applications can be made online, and require supporting documents. Fees are typically 2-3k , with 28 days for consultation and 4 months for procedure. http://www.sepa.org.uk/regulations/water/pollution-control/ Marine Scotland Marine Licence (Section 20, Marine (Scotland) Act 2010) covers discharges from wellboats on fish farms.
	WAL: Marine Licence for navigational risk (replacing the previous consenting regime under the Coast Protection Act 1949) NI: Written confirmation from the Maritime and Coastguard Agency that the proposed development will not create a navigational hazard (marine sites only Wales - NRW is responsible for the Marine Licence process SCOTLAND: Marine Scotland Marine Licence (Section 20, Marine Scotland) Act 2010) covers navigational risks replacing the previous consenting regime under the Coast Protection act 1949). http://www.gov.scot/Resource/0047/00479072.pdf
	Eng - please see section under Animal Health SCOTLAND: The Alien and Locally Absent Species in Aquaculture (Scotland) Regulations make provision for the enforcement of Council Regulation (EC) No 708/2007 and for the notification of both an intended movement of an Annex IV species and the translocation of a locally absent species from within the United Kingdom. The movements of two of the Annex IV listed species – Crassostrea gigas (Pacific oyster) and Oncorhynchus mykiss (rainbow trout) are exempt from the Regulations. For the other species listed, where measures are considered necessary to restrict the use of Annex IV species, the movement must be notified and may then be prohibited or allowed subject to any conditions by means of a notice or an environmental risk assessment may be requested. http://www.legislation.gov.uk/ssi/2015/103/made

	ENG: Those operating in the aquaculture sector must also abide by the Gangmasters (Licensing) Act 2004; veterinary medicine mixing licence might be required (Veterinary Medicines Directive (EU Regulation (EC) No 183/2005 laying down requirements for feed hygiene); Transport authorisation under Aquatic Animal Health Regulations; Animal Transport Certificates under The Welfare of Animals (Transport) (England) Order 2006. Permissions to supply and introduce fish into inland waters - (England and River Esk catchment area) Regulations 2015. WAL: License for collecting mussel seed (granted by the Welsh Government). The Welsh Government has the powers to grant Several and Regulating Orders under the terms of the Sea Fisheries (Shellfish) Act 1967 to encourage the establishment or improvement of a shellfishery. SCOTLAND: Escapes from fish farms represent a loss of valuable assets. For conservation and wild fish interests, escaped fish may represent a disease hazard, occupy valuable habitat to the exclusion of wild fish, and have the potential to interbreed with wild fish, leading to dilution of genetic integrity. All fish farm businesses in Scotland are authorised and inspected by Marine Scotland for measures in place to contain fish and prevent escapes with a range of sanctions available where non-compliance is identified. The Aquaculture & Fisheries (Scotland) Act 2013 includes specific powers to prescribe statutory technical requirements to ensure the installation and deployment of fish farming equipment that is well maintained and appropriate for site conditions. It also imposes a duty for training to use prescribed equipment and requirements on operators to keep records. The Scottish Government published a Technical Standard for Scottish Finfish Aquaculture, in 2015 : www.gov.scot/Publications/2015/06/5747 http://www.gov.scot/Topics/marine/Fish-Shellfish/18364/18692

Table 21 Questionnaire. UNITED KINGDOM. Section 2.

2.1. Type of permission	ENGLAND	SCOTLAND
a. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	Abstraction and Discharge Consent (Volume metric to be allowed to use). Authorisation to operate an Aquaculture Production Business. Annual health check from CEFAS and inspection of farm records. Annual Category 2 Parasite check. Aquaculture authorisation run by DEFRA (CEFAS): only a piece of paper that is needed to operate an aquaculture facility; Title = "Authorisation to operate an Aquaculture production system", very little law attached to that (installed within the last 5 years, probably EU suggested?) As long as you seem to comply, they leave you alone Charges were recently increased	All licenses are permanent. (described in 2.1 c) SEPA offices are looking more intense into other water-using industries SEPA happy to have self-regulation in place
b. What permission(s) is/are needed to OBTAIN the license for EXPANSION of an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	As above. No permission needed to increase production as long as you stay within conditions laid down in abstraction and discharge licence.	Changes are possible. Major environmental events, then you can be forced to revoke the license. (see 2.1 c below)
c. What permission(s) is/are	As above. Permission needed	New + expansion is similar

needed to OBTAIN the license to establish a NEW trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	from CEFAS and Environment Agency.	Pre-application is different There is no main (joint) authority for this 1: Planning authority: Local amenities (as for house, structures), visual impacts, roads. Some authorities are strict towards aquaculture. Planner give recommendation to planning committee. Committee is not bound of recommendation of planners. 2: SEPA. All EIA, discharge, waste management, medicine, chemical, for land, sea, freshwater, sea cage. Local offices, discuss new plan with them. Differences in offices, there is app. 8. Land: Regulation and discharge, abstraction came into place since 2007. New regulation from Water Act. But EIA fall under local authority, not SEPA. EIA regulations kick in from local authorities. For sea sites is well known what needs to be done (similar to salmon industry). For land-based not, because there are no new sites, especially not for trout. Since 2010 sea cage EIA also under local authority. Local and SEPA interact /consult each other. SEPA also require multi-consultation. Local authority would want SEPA license first, local to be more comfortably with their work. Waste feedback under SEPA. 3: Aquaculture business license (actually only notification), Marine Scotland. Allow to hold animals. Disease, etc. Any changes are only amendments, easy. They do health audits. Mortalities, removing carcasses. - Apply to owner of sea bed to use the sea
d. Who can apply for such a permission (e.g. farm owner, producer association)?	Anyone.	Anyone, In principle.
e. What qualification is needed to apply (e.g. work experience as farmer, relevant degree or diploma)?	None.	No requirement from government Maybe some very general environmental, animal husbandry qualifications. Proof that you have enough funds to remove equipment if production stops. Customary requirements are stricter, e.g. training staff in wel-

		fare and working condition. Internal quality scheme - Degree of experience 5 – 10 yr - For manager. HE degree animals, livestock, husbandry - Lot of internal training - SVQ Scottish vocational qualification - Courses - Health - Hygiene - Sea training (working conditions and safety)
f. How long is a permission valid?	At present it is forever.	All 3 are permanent. Changes are possible, of course. Major environmental events, then you can be forced to revoke the license. 1 example of 10 yr limited license sea cage, appeal to government, decision still pending. Licenses are transferable, can be sold Someone can have a planning license, but not a SEPA license Transfer of license is easy
g. How frequently do you have to re-apply?	N/A	Only in case of changes in production or legal basis
h. Is there a difference between "old" licenses and new licenses (e.g. license stemming from before 1992, Foundation of EU)?	Probably.	New license for sea, SEPA changes this now, monitoring, notification timing fish on site, fallowing Biggest change in 2007, when change from pollution act big regulation change, but didn't make conditions any different.
i. If there are such "old" licenses, what are the main practical differences to new licenses?	Tighter discharge controls. The new WFD wish to change the licences permit with presumption of renewal every 12 years. If during the 12 years, the river is under threat or they wish to change the regulations - it could lead to a redraw of the licence without compensation. Non-consumptive use of water for this farm, often it is in better conditions afterwards No money from the bank, if the farm will be gone after 12 years	-
j. What kind of permission do you have for your farm?	As above, before 1992 - Licence to farm fish granted by DEFRA (CEFAS) - with approx. 6 pages, allowing to abstract water & to discharge. Environmental Agency (EA) for water supply - on the amount of difference in water level BOA, priorities how to maintain	For sea water farming: - Well boat license - Permission for moving on sea bed - Navigation-related

	the river	
2.2. Legal framework		
a. Which laws (laws/departmental orders/ statutory instruments/directives/guidance and/or other forms of public regulations) are applied to regulate the permission process (see 2.1)? Please indicate if the laws are specific for aquaculture (A) or of a more general nature (G). Please give full name (in national language and English translation if possible) and link to website (if applicable).	Lots! Mainly coming from CEFAS and EA. Laws are fairly specific for Aquaculture.	-
b. On which regional level(s) are these laws effective (e.g. whole country, state, region, municipality)?	Whole country. Some are regional specific.	Whole country. Some are regional specific. Within SEPA rules there are differences between Highlands and Islands Regulation about how to dispose dead fish, different regions for how close to an incinerator or safe point of disposal
c. How frequently are the relevant laws changed?	Not often until recently.	-
d. When was the last major / relevant change in the laws, concerning aquaculture, that you can remember?	Laws not changed, but re-evaluate the charges and enforcement guidelines	Industry consultation: SEPA talks with stakeholders BTA responded to consultation (charge, enforcement, spatial planning)
e. Was this change directly related to an election or a new political party taking over the government?	No	In Scotland Trout gets 'lumped in to the same bag' as salmon aquaculture industry sector. Salmon largest exporter in United Kingdom and huge amount money for Scotland. Government is very vocal to show that they support the industry.
f. What was the motivation for this change in the laws?	Environmental and welfare	SEPA precautionary principle. Afraid of EU regulation coming in.
g. What was your opinion on the necessity / meaningfulness of this change?	Inevitable. Motivation is positive because of strong sector. Maybe adverse effect of more costs - Whatever happens in the EU, United Kingdom will probably follow and have to changes anyway. English fish farming has been getting away for a long time. Especially now with the WFD it will have an effect, anyway England has it easy in comparison to most European countries.	Review process for sea water concessions, radical changes to increase their development, to promote the sector.

2.3. Permitting authority		
a. Where do you have to apply? Please give full affiliation of the MAIN permission granting authority and link to website (if applicable).	Apply to Environmental Agency for water supply. Natural England CEFAS (part of DEFRA (=Department for Environment, Food & rural Affairs); look after everything that EA doesn't, keep an eye on the countryside; with people that come and check). Chances to have a new permit is small	1: Environment Agency (EA). Regulatory: Licences waste and veterinary discharges from fin fish farms & Abstraction and Discharges under Environmental Permitting Regulations (England & Wales) 2010 (as amended). Statutory consultees to Local Authorities for development consents. Tasked to deliver water quality objectives for protected shellfish growing waters so consultees for applications for shellfish. Authorisation: Abstraction & Discharge Licences. Fish supplier permitting. 2: The Crown Estate (CE). Regulatory: Grant seabed/foreshore rights for aquaculture developments. Authorisation: Seabed/Foreshore Lease 3: Maritime & Coastguard Agency (MCA), Regulatory: Works towards the prevention of the loss of life on the coast and at sea. Production of legislation and guidance on maritime matters, and provide certification to seafarers. Authorisation: Documentation/training of Seafarers, Seafarer Safety and Health, Counter Pollution, Environmental Policy, Search and Rescue, Survey and Inspection, Ship Standards, Enforcement, Receiver of Wreck 4: Natural England (NE), Regulatory: Government advisors on natural heritage protection, particularly designated conservation areas. Statutory consultees to planning and licencing authorities. Authorisation: None 5: Veterinary Medicines Directorate (VMD). Regulatory: protects animal health, human health and the environment. Sampling and monitoring of aquaculture premises. Authorisation: Marketing authorisations Approval for manufacture of medicated feeds. 6: Inshore Fisheries and Conservation Authority (IFCA). Regulatory:

		Fisheries & conservation management and enforcement under the Marine and Coastal Access Act 2009, national and European fisheries legislation. Authorisation: Inspection of vessels & premises Permitting of certain activities. 7: Animal and Plant Health Agency (APHA). Regulatory: Welfare in Transport, at slaughter & on farm. Fish Mortalities (regulation via local authorities). Authorisation: Transporter authorisation. Animal Transport Certificates.
b. Please indicate the geographic coverage of the authority's responsibility (e.g. for the whole country, federal state, county, municipality, city).	EA is divided between England, Wales, Scotland and Northern Ireland. CEFAS/Natural England: cover total England and Wales; head office in big cities	EA is divided between England, Wales, Scotland and Northern Ireland. CEFAS/Natural England: cover total England and Wales; head office in big cities
c. Which further authorities are involved in the process? Please give affiliations.	Depends on how sensitive the area is. Possible local planning authorities. Body of fish diseases (inspector) part of DEFRA. Authorities are asked to work more together.	Various departments in marine Scotland No communication within marine Scotland, no exchange between departments

d. Is there any mandatory third party involvement in the application process (e.g. research institutes, state agencies, third party experts; e.g. for statements, review of application)?	Not really, it would probably help. Might be more relevant for new licenses. It would help the farmers to get through the permission process more easily. Consultants are available, but need to be paid by farmers. Certification: require independent / approved environmental assessor, review of business, to be environmental sound	- Under EIA, - Formal consultation process - Scottish national heritage (wildlife, plants) gov. advisory agency - Marine Scotland science department - Wild fisheries trust - Salmon fisheries board - "anyone" can be included, local community councils (elected members of community), e.g. small areas, around 8 people per council - public consultation, everyone can send in support or not support - confirm: major problem with retired, wealthy land-owners, because the land owner can see the farm and feels it devaluates the land. Campaign against whole company. Turning projection against company. - No need to prove personal stake in the case. Objections from Australia. - Public hearing on websites, ranges from 8 to 4 months' duration, 28 days' consultation time. SEPA process is strict in 28 days. Planning and EIA are more open to public opinion.
2.4. Application process to achieve production permit		
a. Is there more than one application necessary to MAINTAIN a license?	No	Yes, in fact 3
b. Is there more than one application necessary to OBTAIN a NEW license?	They would all be applied for at the same time.	They would all be applied for at the same time.
c. Is there more than one application necessary to OBTAIN an EXPANSION of an existing license?	They would all be applied for at the same time.	They would all be applied for at the same time.
d. Can you draw a (generic) flow-diagram for the license process, beginning with the preparation of the application until the final decision, including all parties involved and the main milestones (see example in Appendix page 180)?	-	-

e. Are there templates or guidelines available for the application? Please provide reference / source.	Yes, good templates available. There is a new web-site for aquaculture (in England): www.seafish.org/industry-support/aquaculture/aquaculture-regulatory-toolbox-for-england Here you will be guided to the regulations/laws and the responsible authorities. Digging further into this, you may find templates and even on-line schemes to be filled out - e.g. this: https://www.planningportal.co.uk/info/200126/applications	-
f. In which language can you / do you have to apply?	English	English.
g. How much does the application cost (e.g. administrative fee for obtaining the license)?	Less than £500 in 1974	For large fish farm, major changes: 17.000 pound per application (maximum fee). Smaller changes, increase biomass, water use, increase cage numbers, technical changes, fee 4000 pound Change in name, non-technical changes: 100 pound Fee is due on 1st day. No refund when application fails Meant to cover direct costs of offices, technical reviews, Fee system hasn't changed much for years Industry: more transparency is required SEPA will become more transparent, also for annual charges Planning: lump sum, no transparency, no recurring cost, based on area of land / sea bed SEPA annual fee based on production, discharge, chemical, "magic number"
h. Is there a fee for the license as such (e.g. fee per production volume/area, etc.; apart from any administrative cost)?	Yearly abstraction and discharge fee.	Same fee as above, no extra license fee
i. What is the official expected time to process the application (until decision – weeks? months? Or years?)?	A few months.	SEPA: 4 months + 1month consultation. Planning: with EIA: 3 months Without EIA: 8 weeks Planning is always exceeding the timelines. As a developer, you can only assume that the application is rejected and then go to appeal. No enforcement above planning.

j. How long does it actually take to get a license (e.g. based on the average of the last application process you know)?	3 months.	Planning: 6 months to a year.
k. What are the main causes for delays in the process (e.g. expert & public hearings, appeals, environmental impact assessments (EIA), law suits, etc.)?	All these examples would have a slowing impact.	Biggest delayer: requesting more information Not EIA & not appeal
l. Is there a legally binding maximum time the authorities can work on the application before giving a decision?	?	?
m. What documentation is needed for the application (e.g. map, GPS-location, description of facility, technical sketches, technical leaflets)? (See also questions to the use of specific technologies in section 2 and 3, below)	Massive documentation needed. - Location - Maps - Constructions plans - Design - Discharge - Impact assessment report (EIA) - photos - historical flooding's The more that can be provided the better. No regulation what you have to send them. Nice if guidelines were available. Employ an expert: fish farming consultant (Not many around); EA have a list of people who would consult, e.g. a company for impact assessments. Did not go through it himself.	A lot for planning, same as with EIA Plans, models, maps, EIA, wildlife reports, surveys, … Typically companies submit everything, just to be sure. Huge time requirement for sea site extension: 6 months' planner staff + extra consultants, around 10.000 pounds Complete outsourcing: 60.000 pounds Probably less for land-based, because its less polluting or less controversial More nervousness for sea farms SEPA only modelling report.
n. If there is more than one application involved in the process, how do the applications interact?	All applications would interact as one. Eventually all the application papers end up at EA	
o. Is there one application that is superior to the others?	"Aquaculture authorisation" would come after the permission; aquaculture is considered to be agriculture; fall out of most of the planning laws (aquaculture facility buildings)	
p. Are the application processes completely separated from each other?	No	Planning and SEPA interact with each other, consultation Inefficient consultation, redundant / twice the same kind of consultation
q. How do the different authorities interact with each other (e.g. based on a formalized procedure)?	Probably not very much.	
r. What happens if one application is rejected?	Right of appeal.	That's it. Right of appeal.
s. What kind of written "proof" (e.g. verdict, official letter, certificate) do you receive in the end?		Letter of planning permit (maps, conditions) and SEPA license, few page document.

t. What is easier? Apply for a renewal of an existing license or apply for a completely new license?	Renewal is not applicable at present. I suspect it would be impossible now to apply for a new farm. Certainly very difficult.	
u. What kind of application process did you have to go through?	A fairly simple written process.	
v. Can you give us a copy of this document for your farm? (permit/license to produce and/or water abstraction permit/license).	Last one from 20 years ago Very similar to old one Categories in general didn't change	
w. What are the possibilities to complain or appeal a decision of refusal?	You can appeal. But you can't win. The EA thinks they have the ultimate decision. Only big farms have the ability to do so. But you can talk with EA about negative decisions and improve the application. Smaller farms are less likely to get a no, due to the fact that environmental issues are not so big. If BTA has good reasons to help, they would do/ and have done. There are no time regulations for a renewed application theoretically.	-
x. Does the fish farmer have to appeal himself or will the farmer's organization do it/assist the farmer?	Up to the individual but BTA would help if needed.	External consultant for technical assistance, modeller, Easier to have an independent person doing the assessment, more credibility, more authority, especially sensitive topics, e.g. landscape planning
y. Will an appeal be dealt with by public authorities directly or will it be necessary to start private proceedings?	Directly to public authorities but both ways are plausible. If Planning permission is denied, after 10 years you can reapply after an appeal for the first time! If you redraw the application you can do another application right away.	Scottish government
z. Can the expenses for an appeal be estimated?	Very expensive Planning permission alone maybe 5.000-10.000 £	Expensive when lawyer or consultant help is needed
aa. What is he expected time span for the appeal to be accomplished?	2-3 years maybe Departments have to reply within 6 weeks	2 months to appeal Few weeks for the appeal

6.1.5.2 RELEVANT RESTRICTIONS IN RELATION TO PERMISSION / LICENSE

The introduction of WFD in the United Kingdom has mostly led to a very sensitive assessment of phosphorus discharge into Scottish sea lochs. Here, the respective authorities impose regulatory power on the basis of environmental protection. The usage of surface water from rivers is also strictly regulated in this respect, but the environmental agency (EA) in England applies a rather simplistic approach to the regulation (fixed abstraction volume) which does not necessarily reflect the actual (seasonal, climatic) condition of the watershed in question. Instead, the operational level (e.g. correspondence with farmers, intervention in case of flooding, draught and other sever event) is preferably handled by experienced staff members of the authority, which know the local characteristics of the water body from the back of their heads. Changing this well-established system to a more "proficient" (i.e. based on computer models of watersheds, centralised competence in the bigger head offices of EA or alike) is perceived a big loss of competence and a major. The section on "performance of permission" is missing for the whole of United Kingdom, because it was not possible to give a clear account of the interview partners feedback without revealing their identity. Instead, we have maintained a lot of the verbal quotes from the phone interviews in the following table, to give an impression on the farmers' opinion.

Table 22 Questionnaire. UNITED KINGDOM. Section 3.

3.1. Size	ENGLAND	SCOTLAND
a. Is there a production size limit for the permission (e.g. maximum production volume, feed usage, water usage, area)?	Water usage only.	SEPA put capacity in license, maximum 2500 tons in sea water Size of site is site-specific, based on spatial model, Model of dispersion, sea bed effects, Monitoring every production/crop effects on sea bed SEPA uses computer model that would allow bigger licenses, since 8 years Monitoring to validate the model Bigger licenses maybe earliest end of 2016, then more monitoring History: 1 km square grid, no effect beyond the grid, otherwise cut-back of biomass, about 8 years ago. The new model approach allowed for many expansions, especially in salmon. Opened a whole new capacity. Freshwater loch: no modelling, all based on Phosphorus-level, based on waste, as requested WFD
b. What is the maximum size of your production you are allowed to have?	Unlimited. No restriction Every ton extra allowed within water permit	-
c. Are there different requirements for different sizes of production (e.g. full EIA for a large farm, less detailed investigation for a small farm)?	No but this would be relative to the estimated size of unit/production.	2 ha (expansion or new) requires EIA All fish farmers will go through EIA to stop the further request of further information
d. What are the thresholds, if any?	It depends. None really.	In theory

e. In case, permissions are limited by production size, can you apply for more than one permission?	N/A	N/A
f. What are the conditions for doing so?	N/A	N/A
3.2. Facility type		
a. Are there different requirements for different facility types (e.g. earthen ponds, concrete ponds/raceways, indoor/outdoor, flow-through, partly-recirculated, located in country-side or in an industrial area)?	Not really but it would probably be taken in to consideration. Small changes require no changes. Local planning is limiting the buildings	Location and three types based (land, freshwater loch, sea cage)
b. Is there any kind of production facility that would be generally considered IMPOSSIBLE to get a permission for (e.g. see above)?	Not known	No. Freshwater loch is hardest. SEPA is mostly afraid of WFD consequences. They would like to get rid of freshwater lochs.
3.3. Water		
a. How much INTAKE water are you allowed to use?	As decided by the EA. Non-consumptive usage of water. At the moment the authorities would say that you can take xy gallons water per day, whether if there is that much water in the river or not.	No statement on seasonality or diurnally. SEPA has not expressed to account for seasonality, but in the future they will say that you can only take 50 percent of the river flow. Industry opinion: There should be account to Season! Consistency is key! Producers might not want to change the system, but could use some flexibility when there are draughts. When there is a draught, more water would be needed. Static system, not flexible to seasonal needs

b. What OUTLET water composition do you have to fulfil?	Example: The discharge shall consist only of water abstracted for the purpose of fish farming, and shall be of the same quality as the abstracted water at the point of intake in that: Suspended solids 5 mg/l more than intake BOD not exceeding 3 mg/l or may not be more than 2 mg/l higher than the intake water, whichever is the greater Ammonia-N, shall not be increased by more than 0.3 mg/l compared to the intake water DO-saturation 80% in outlet or at same level as inlet, whichever is the lesser This frame is given for a certain allowed amount of water abstracted for the specific farm.	Cage freshwater: phosphorus, based on WFD Oligotrophic lochs, different thresholds for different trophic levels. WFD says overall good status threshold between 8 and 16 Sea cage: benthic effects, species composition, redox, particle size analysis, within SEPA requirements No water quality requirement, because it benthic effect is easier to monitor
c. Is there an ABSOLUTE (irrespective of production volume) limitation on the intake / outlet water QUANTITY (e.g. expressed as litre per second or percentage of a river flow)?	There would be now. This happened very rarely in the past.	
d. Is there a RELATIVE (in relation to production volume) limitation on intake / outlet water QUANTITY (e.g. volume per kg produced, volume per kg feed used)?	No	
e. Are there ABSOLUTE requirements for the COMPOSITION of outlet water (e.g. maximum content of nitrogen, maximum suspended solids)?	Yes, mainly incremental. What is on the licence: an incremental discharge of water rather than an absolute. Absolute limits are difficult for the farmer; relative ones are better: Don't lower the quality for a certain amount in comparison to the inlet water. This is site-specific (from old days). Old offices that gave the licences had different views on what is good or not. But this will change in the near future (WFD) and obstruct licence reform.	
f. Are there RELATIVE requirements for the COMPOSITION of outlet water (e.g. nitrogen discharge per kg produced)?	See above	

g. Are there RELATIVE or ABSOLUTE requirements for the COMPOSITION of outlet water in relation to the flow (e.g. e.g. nitrogen discharge per litre outlet flow and/or related to concentration in the inlet flow – in other words: additive load per water volume)?	No	
h. Is there a fee/cost for using/abstracting the water from the river/the well? If so, what are the cost/fee?	2200 - 10.000 £/year related to the water abstraction volume. Not implicating on suspended particles, etc., as the water is for non-consumptive use.	SEPA charges based on volume - Complicated algorithm
i. Is any or all of the above restrictions limiting the production on your site (e.g. when your river / well has more capacity than you actually are allowed to use)?	This differ among farms: 100% water is key, because space is not limited, growth constraint Restricted on discharge and biological parameters	
3.4. Sludge		
a. Is it mandatory to collect and remove sludge?	No, no matter of concern for authorities for the moment being. Some farms have no catching of sludge - it goes directly out to the receiving river. Some have drum-filters and some settlement channels. No restriction for the use of sludge (e.g. as fertilizer for agriculture)	Depends on site and receiving water, e.g. a small river Typically crude measures to collect sludge SEPA requires some technologies SEPA checks if you depose your sludge correctly
b. Is there an ABSOLUTE limitation on sludge quantity (e.g. tons of dry matter per year)?	No	
c. Is there a RELATIVE limitation on sludge quantity (e.g. kg sludge per kg produced)?	No	
d. What further usages of sludge are allowed (e.g. as fertilizer, biogas, composting, dumping)?	All allowable	Defined by waste regulation Receipt for picking up the sludge
e. Is your permission / license linked to a sludge quota (e.g. maximum allowable quantity per year)?	No	No
3.5. Feed		
a. Does your permission / license specify any limitation on the feed you use (e.g. brand, country of origin)?	No legislation on type of feed or how much feed. No EA involved. No regulation for contents in the feed, but super-markets in United Kingdom don't allow land-animal products (blood-meal, feather-meal, bone-meal) in the feed (supermarkets=customers of fish farmers). Difficulties to find feed suppliers. Some farmers still produce their own feed.	None.

b. Is there any specified requirement for the feed components, composition (e.g. feed specific N-, P- content, N-, P-discharge, faecal stability, digestibility)?	No	No
c. Is your permission / license linked to a feed quota (e.g. maximum allowable feed quantity per year)?	No	No
3.6. Land / area usage		
a. Are you the owner of the land / area that you are using for production?	Owner Many producers rent land or might rent only site itself	Lease contracts are more flexible. No implications for license Agreement/lease with the landowner, duration based on negotiation You cannot own land for a sea site, one pays a levy based on the production volume, goes to crown estate office in London, uses for projects
b. If you are not the owner, which legal status / agreement do you have with the actual owner (e.g. a lease contract)?	N/A	Contract with owner
c. How does this ownership-status affect your rights in relation to production permission / licensing?	Other environmental impacts: if trout producer site is on a farm or industrial, conflict with other industries, on the same area/waterbody/river basin	No implications for license
d. Is there an ABSOLUTE (irrespective of production volume) limitation on the area usage (e.g. expressed as ha water surface area)?	No	
e. Is there a RELATIVE (in relation to production volume) limitation on the area usage (e.g. water surface area per kg produced, area per kg feed used)?	No	
f. Do you have a requirement to work in different intensity levels on certain areas of your property (e.g. leaving one pond untouched as compensation area for producing in another pond)?	No	No requirement in freshwater lochs to fallow Sea cage: fallowing 6 weeks every 24 months, alternative arrangements are possible, mainly based on sea lice and disease management
g. What are typical spatial planning conflicts with habitats, protected areas? Please give an example.	This is site dependent	All! Spatial plans are frequently outdated, spatial users disappear. Frequent updating need, frequent consultation is needed. For some peace - you can buy out landscape capacity. Application can be rejected because of cumulative spatial impact. At sea e.g., finfish and mussel farms, even there are no mussel farms. Answer: Buy out mussel license

h. How close is/are your farm(s) located to a protected environment (e.g. Natura2000, etc.)?	Many farms with such areas - but was original not. If these farms were to be established now, it would not be allowed as they are situated in SSSI = Site of Special Scientific Interest (sensitive) (Natural England) Only RAS would now be possible	Assessment, site-dependent
i. How does the site location affect the permission process (e.g. when located in or close to a Natura2000 site)? Please give an example.	No permission would be given.	National Scottish Heritage, this authority will deal with biodiversity.
j. Are there any areas that are PRECLUDED from trout farming (i.e. where the government really wants to have no farms)?	Probably	Sea water, east coast of Scotland, to protect wild salmon stocks from sea lice, MoU
k. Are there any areas that are PRIVILEGED for trout farming (i.e. where the government preferably wants to have farms)?	Probably	None
l. Does your fish farming permission / license regulate your property usage (e.g. in terms of percentage of land that must not be built on)?	No idea -Probably not. “fish farming is not agriculture” Only for the building of houses a permission is needed. Storage rooms (agricultural building, workshop, etc.) within the licence. Introduction of new technologies possible Planning commission for a full-recirculated-farm probably necessary, grey area	All regulated under planning

3.7. Predators and other wildlife		
a. What "general" measures are you ALWAYS allowed to use against fish-eating predators (birds, otters, etc.) (e.g. noise deflection)?	This is dependent on local planning laws. Netting & fencing If fencing happens in a SSSI area you need a special planning permission for building the fence. EA only suggests to have nets, but not mandatory. Passively deflecting systems allowed. One can apply for a shooting license - but it will be restricted to a few birds/year and thus have little effect. Herons, kingfishers, eagles, cormorants are the 'usual suspects'. Locally otters can be a problem, but no trapping or lethal avoidance legal - only fencing.	Land: tanks: in housing, closed doors Ponds: netting over top OR over entire site, no "one way", site-dependent In freshwater cages: bird nets on cage, for otters: tougher net at water line Seawater cage: bird net, various measures against seals, only when necessary, seal blinds, double netting at bottom so that they can no reach mortalities, acoustic deterrent devices (pingers), not constant running, otherwise seals become used to it Scottish National Heritage sometimes won't allow use of devices, because of dolphins and whales Shooting of seals: highly licensed, quota per area, last measure only Most farms are far away from seal spots. License from marine Scotland Planning permission specifies area were you are allowed to use acoustic deterring device No bird shooting necessary (cormorants not an issue), netting is efficient. License from Scottish National Heritage.
b. What "special" measures are you ONLY allowed to use against fish-eating predators (birds, otters, etc.) when you are in possession of a special license or in dedicated areas or times of the year (e.g. gun shooting only with hunters' license)?	Only when you can prove you have tried everything passive possible (netting the farms; electric fence; cage over the farm) you can get a licence for shooting herons and cormorants A shotgun licence for owning the shotgun is needed.	
c. What measures are you NOT allowed to use against fish-eating predators (birds, otters, etc.)?	Most!	Acoustic deterring devices in special designated areas for whales Shooting birds in special seasons
d. Which of the above mentioned measures to use against fish-eating predators are most frequently used in your country?	Netting & fencing Maybe CD's (noise) Otters don't like electric	
e. Is there any practical experience / scientific documentation or other source of evidence for the effectiveness of these measures in your country? Please provide source name and web-link if applicable.	Various. Mainly produced by the EA	Questionnaire to Scottish government No real public report

f. What other "problematic" interactions with other types of wildlife (other animals, plants, etc.) do occur?		Sea lice interactions with farmed and wild fish Sea lice don't seem to be an issue in brackish and freshwater Huge gap of knowledge of interactions between wild/farmed No problem with whales/dolphins in general (except in respect to acoustic devices)
g. How are they "typically" regulated? Please provide reference and web-link, if applicable.		
3.8. Energy		
a. Does your permission impose any requirements / regulations on your energy consumption (e.g. maximum kWh use or kWh per kg produce)?	No	No
b. Are there any requirements to maximum amount or demands on reduction of energy used – when OBTAINING a MAINTENANCE license (if this is applicable in your country)? (e.g. per kilo produce, percent reduction to comply with - or otherwise?)	No legal regulations Voluntary certification schemes may favour energy savings; Quality trout: GAP, Freedom Food, Tesco certification.	
c. Are there any requirements to maximum amount of energy used - when OBTAINING a NEW LICENSE? (e.g. per kilo produce or otherwise?)	No	
d. Does your farm have a connection to the public electricity grid or do you use other means to generate electricity? Please specify (e.g. Diesel generator, solar panels, proportion of renewable energy).	Everybody connected to public electricity Generators for emergency (power cut) No incentives for solar panels	Mostly connected On sea sites generators Mostly gravity fed sites, no pumping No heating
e. Does your permission create any incentives / benefits to safe energy in production or to use renewable energy sources e.g. windmill, solar (Renewable energy sources is a must in organic production)	No The use of renewable energy would benefit during a licence application. But authorities don't care in general about how much electricity you need. Some farms have own idea to reduce electricity and oxygen cost.	Not on sea site On land for a new site, might require renewables Government has a high policy for renewables, unsure how for fish farm Cut-back in hydro schemes grants Solar-panel grants cut back as well
3.9. Interactions with other stakeholders		
a. What are "typical" regulations that affect your interaction with other stakeholders, like: (Please give examples and references, if applicable)	EU habitat directive-related Abstraction licence gives a certain amount of protection from upstream abstractors.	Planning application All people would be included in pre-consultation Formal consultation during application phase
○ Recreational anglers	No problems with anglers, they concentrate their efforts on salmon farming in Scotland	Fisheries trust, local collective anglers

○ Migrating fish organizations, conservation organizations		
○ Environmental NGOs	EA const. under pressure	Anti-fish-farm campaigners, but not organized as NGOs (SEPA, Scottish National Heritage, Marine Scotland)
○ Tourists and tourism industry	No	Not tourism, maybe comments from local businesses
○ Agriculture, farmers	In dry summers farmers take a lot of water for irrigation. Drainage water from agricultural areas will then also be an important part of water flow in some areas - and the content of nutrient can then be high (& possible residues of pesticides/herbicides).	Other fish farmers (being a good neighbour)
○ Water energy, power dam operators	No	Power dam, few sites takes compensation from hydro scheme Example: Very deep reservoir, taking water from 10m, no problem in dry years, no threat of water shortage
○ Others (please specify)	Disease of migrating fish originated from farms is not a topic anymore	
3.10. Veterinary and animal welfare affairs		
a. How frequently are you interacting with your veterinarian?	As needed	At least once a year on every site Main veterinary service, some bigger companies with own veterinarian (regularly inspection on sites, can do prescriptions, risk-based, general improving production). Part of Freedom food standard, vet health plan, updated monthly, reviewed yearly Fish health dep of marine Scotland as part of aquaculture business license Look for notifiable diseases University of Stirling has fish courses Foreigners as well If vet is too expensive, then they have a biologist

b. What are the most common reasons for you to work with a veterinarian?	Fish health problems and obtaining prescriptions. Prophylactic: Most large trout farmers in United Kingdom (table size trout) have a Veterinary health plan (voluntary), made specifically for the farm. Covers all health issues on the farm e.g. vaccination plan, stocking density; electronic documentation; voluntary thing, self-created. VHP written with Fishvet group expert, 30-40 pages. CEFAS did nothing; part of the discussions with CEFAS for inspectors etc. General structure or public guideline not available, but VHP stated in the Quality Trout Certification scheme and the Veterinary health plan is necessary for the audition.	-
c. What permission(s) is/are needed to MAINTAIN / RENEW the license for an existing trout farm? Please give full name (in national language and English translation if possible) and link to website (if applicable).	None at present	-
d. What kind of veterinary approval is required to obtain the permission?	None	-
3.11. Medicines & chemicals		
a. Are medicines only available after veterinary inspection and prescription?	Usually	Yes. Some can hold a license as a veterinarian - to be allowed to take prescriptions.
b. Are you allowed to store veterinary prescribed medicines at your farm?	Yes, allowed to keep medicine in stock.	
c. If yes to b: Under which conditions are you allowed to store medicines – and in which amount?	Safely Locked up cabinets on the farm. allowed to store antibiotics.	
d. Is it mandatory to register the medicines in storage?	Yes	
e. Are you allowed to apply the stored medicines at your own or only under veterinary instruction?	On our own	
f. Is it mandatory to register the use of chemicals and medicines? If yes: How do you register?	Yes, We have to fill in a medicines book, kept on site.	

g. What kind of medicines & chemicals are you allowed to use (e.g. formalin/ formaldehyde, salt, hydrogen peroxide)?	Formalin (is under review- is carcinogen. Still used professional under Regulations (gas mask, etc. As BTA working with DEFRA, installing a guideline how to use it, also for land animals) Peracetic Acid Peroxide Virkon s Chloramine T (for gills flush) Emamectin (slice) for fish destined for angling. Allowed to use medicated feed Prescribed antibiotic from the vet Mix the antibiotics into the feed on the farm Keep a sample frozen of that food Keep track of redraw time before selling	No prophylactic.
h. What kind of medicines & chemicals are you NOT allowed to use that you historically did use (e.g. malachite green)?	Malachite.	
i. Which of these substances do you use regularly to treat your fish?	Salt	
j. Please list the medication you normally use (based on a veterinary prescription).	Emamectin (slice) for fish destined for angling.	
k. Do you use vaccinated fish in your production?	Yes	Bath vaccination, many do it themselves Injection vaccines by specialised team Oral boost vaccine, mixing with feed, license to do so on site and/or by feed companies.
l. Do you vaccinate yourself or do you buy already vaccinated stocking material?	Ready vaccinated	
m. Which of these substances do you use regularly for other purposes (e.g. disinfection between production cycles, disinfection of equipment)?	Satisfying for use: Per acetic Acid is difficult, formalin is easier Allowed to use Peroxide Virkon s Chloramine T for gills flush No coppersulfide	
n. What are relevant limitations for the use of these substances (e.g. maximum allowable use of a disinfectant per production/per water-volume/per kg-fish)?	As laid down in our discharge consent (if they are there at all)	

o. What special regulation exists for effluent water containing residuals from medicinal or chemical treatment (e.g. maximum residual concentration)?	It should be on your discharge consent. EA should be notified. Few farmers do.	

6.1.5.3 SELF-MONITORING AND REPORTING REQUIREMENTS ON FARMS

See initial text at the beginning of the United Kingdom section for our assessment of the role of third party certification in the context of self-monitoring.

Table 23 Questionnaire. UNITED KINGDOM. Section 5.

5.1. Environmental self-monitoring	ENGLAND	SCOTLAND
a. What information (in relation to the above mentioned restrictions) do you routinely monitor and document yourself as a farmer? Please indicate these metrics here, unless you haven't already done so in the beginning of the questionnaire (see 1.)	CEFAS comes if the farmers have a health problem Strong quality schemes in Quality Trout - has to be followed including the Health plan If farm is situated to a class A-river, EA will inspect unannounced 12-15 times a year, minimum once a month. Self-monitored registration on water supply is strictly monitored. Check the water in and out and parameters in between, also on flow-rates	-
○ Production size, i.e. quantity of fish produced	Yes	Part of environmental permit
○ Use of different facilities (e.g. ponds or raceways)	Yes	
○ Water (i.e. quantity and quality parameters)	Quantity	Part of environmental permit
○ Sludge	No	
○ Feed	Yes	
○ Land / area usage (additional to facility)		
○ Energy	Yes	Self-monitoring under ISO 14001
○ Medicines, chemicals	Yes	
b. How do you monitor and document (writing/filling out tables/formulas in paper, electronically using software on a computer)?	Paper and computer software	Most site has a simple lab
c. Are there regulations that specify how to do the self-monitoring?	Yes.	
d. Is there specific equipment required to monitor (e.g. special types of probes to be used for water quality)?	Yes, a flow meter and Oxygen probe.	Phosphorous analysis (Sea-sites: benthic community - outsourced)
e. When, how and by whom are your self-monitoring documents checked?	Annually by CEFAS and EA	On site check, or sending them in Quarterly, Annual data Send copy of report from analysis

		lab.
f. How long do you need to store them?	Probably 7 years.	4 years, environmental
g. Can you provide us with a (blank) copy of your self-monitoring documents as an example?		
h. What happen if your self-control measures are out of bounce/beyond the limits of your license?	If farmers can't keep the discharge they can get punished, depending on the severity. For certification: Present evidence that you have achieved compliance within 4 to 10 weeks	Freshwater: Upper and lower tier limits can be broken X-times per year, when you fall out with that, you will have a 'Enforcement letter'. You will have to explain what happens and what actions you are going to take. Sea cage, lochs: WFD directed, phosphorus is key, not benthos. Site-specific, based on production quantity, based on checking feed-invoices. When grossly exceeding, then court action. Sea water: Benthic sampling, in case of unacceptable environmental impact, irrespective of production volume, then reduce production volume (SEPA will cut the production)
i. What are the consequences….?	If you fail the check constantly they would take you to court. If a single point in time, they would ask you why this is happening. Chance to respond the questions if there is failure But no strict rule how often you are allowed to fail - depending on the person in EA	
5.2. Environmental controls		
a. Who conducts environmental controls (e.g. authority, delegated institution or the farmer himself)?	EA and SEPA, apart from the farmer. If farm is situated to a class A-river, EA will inspect unannounced 12-15 times a year, minimum once a month. Self-monitored registration on water supply is strictly monitored. Check the water in and out and parameters in between, also on flow-rates.	Biggest change because of WFD Controlled activities regulation: freshwater river Everything is stricter controlled, every year more requirements for documentation, proof Planners at SEPA require always more doc, not always justified SEPA might not feel competent enough to refuse a 'campaigners' question and therefore pass it on to the companies' planner.
b. How frequently are you controlled?	Apart from the regular control of the self-monitoring on the farm - there is an annual inspection of the 'river-quality'	
c. Are the controls announced or spontaneous?	Controls come unexpected. Extra control after fails, will be announced.	SEPA can come any time Can audit any time
d. What kind of documentation is required?	Very little in this connection	

e. What does the controlled check (e.g. environmental index in the receiving water-body (flora & fauna indexes), other types of measuring possible impacts)?	Formerly EA took samples of vertebrates and plants down-stream once a year. Due to economic cutbacks - now mainly rivers with a high SSSI-status (Site of Special Scientific Interest/good-water-quality) will have an invertebrate examination. Water samples also on the water below the gravel to judge the effluent effect on the river. Results of the samples are only sent to the farmers if they fail, but one can ask for the results. EA is paying for all the testing, though farmers have paid through the discharge-fee/license	

6.1.5.4 PERFORMANCE OF PERMISSION

Too individual responses. Left out, to maintain anonymity of interview partners.

6.1.6 COUNTRY SYNOPSIS

Table 24 Synopsis of the most relevant categories of country specific regulations affecting permission and production.

	DK	DE	IT	PL	UK (Eng | Scot)
OBTAINING PERMISSION					
Time to obtain permission	? (RAS: 1-2 yr)	?	? (18 mo – 5+ yr)	2 – 12 mo	3 mo |6-12 mo
Number of permits needed	2	7 [48]	5	7	13 [63] | 3
Validity of (main) permit	10 yr	20 yr - perpetual	4 & up to 40 yr	Max 10 yr	perpetual | perpetual
Renewal of permits	Easier	Easier	Easier	Same as new	NA | NA
EIA mandatory?	Yes	Yes/No	Yes/No	Yes/No	No | Yes
Effective cost for permission	1-13 k€	? (up to 100 k€)	?	15 – 30 k€	? (600 – 12 k€) | ? (max 21 k€ fee, high internal costs)
PRODUCTION					
Limit on facility size	No	No	No	No	No | No
Limit on facility type	No	Yes [41] / No	No	No	No | No
Limit on production quantity	Yes/No	No	No	No	No | Yes
Fee for production, license fee	Yes	No	No	No	Yes | Yes
Fee for water abstraction	No	No	No	No	Yes | Yes
Fee for water discharge/nutrients	Yes	Yes / No	No	No	Yes | Yes
Feed composition requirements	Yes	Yes [41]	No	No	No | No
Limit on feed quota	No	Yes [41]	No	No	No | No
Maximum FCR	Yes	No	No	No	No | No
Mandatory water treatment	Yes	Yes/No [41]	No	No	Yes/No | Yes/No
Limit on chemicals, medicines in outlet	Yes	Yes	Yes	Yes	Yes | Yes
Veterinary controls	Yes	Yes	Yes	Yes	Yes | Yes
Extent of self-monitoring	2 - 26 / a	2-4 /a [41] (regional diff.)	? (regional diff.)	2-4 /a	Yes | Yes

6.2 TECHNOLOGY LEVEL

There are a wide range of regulations and standards controlling fish farming and the discharge of effluents in Europe, both inside and outside EU. The diversity of legislation reflects the differences in environmental conditions, fish farming technology, species farmed, and the nature and quantity of wastes discharged.

Regulation include: Establishing minimum feed performance criteria (e.g. feed conversion ratio (FCR), nutrient digestibility), placing restrictions on nutrient composition in formulations (e.g. nitrogen and phosphorus levels), restricting feed use, restricting environmentally unsustainable feeding practices and promoting better management practices (BMP) and codes of conduct to improve feed management. In some regulatory frameworks focus is also on monitoring and control of effluent streams and can include; compulsory treatment of effluent

streams prior to discharge, limiting the quality and/or quantity of effluent that can be discharged, limiting farming activities in an area based on effluent carrying capacities/dispersion and/or promoting BMP and monitoring protocols to manage effluent streams.

6.2.1 EFFLUENT STREAMS

Regulations to treat effluent streams prior to discharge can be used to control the potential negative impacts associated with aquafeed use. Typically, such regulations would make it mandatory to install wastewater filtration systems based on mechanical filtration (e.g. settlement ponds, drum filters) and biofiltration technologies. Generally, regulations to treat effluent streams are either enforced at the sector level, encompassing all producers, or on a discretionary basis relating to individual farms and depending upon a specific need to protect a given waterbody.

With respect to imposing effluent stream regulations at the sector level, an example is evident in Germany, where all farms that use pond-based culture systems are required to pass their pond cleaning effluent water through a sedimentation system prior to discharge [64].

An example of the controlling of effluents at the farm level is the United Kingdom, where fish farms are required to apply for a discharge licence. The quality of the discharge water is subject to an environmental quality standard (EQS1) and, for a given waterbody, an environmental quality objective (EQO) is set. The licence conditions reflect these standards and objectives in terms of designating water quality parameters such as levels of biological oxygen demand (BOD), dissolved oxygen (DO) and ammonia in the effluent stream. In terms of conforming to the licence conditions, regulators may specify the use of water treatment systems to ensure that the water quality parameters are met. It should be noted that specifying water treatment systems is only one of the regulatory options that are available to the regulators; thus not all farms will be required to install treatment systems.

Regulations to treat effluent stream have limitations in that they are only suitable for land-based operations such as tank, raceway and pond culture systems, where effluent streams are easily defined, monitored and regulated. They are not suited to open-water culture systems such as cage culture operations, where waste products are immediately released and assimilated into the wider environment.

6.2.2 REDUCING NUTRIENTS IN DISCHARGE

Limiting the concentration of nutrients in discharge waters is a common mechanism with which to regulate the impacts of farming activities and, indirectly, aquafeed use. Depending on the regulatory framework in place, limitations normally focus on total nitrogen and phosphorus discharges, the levels of suspended solids, regulating the BOD of the effluent and ensuring minimum DO and ammonia concentrations. Among others, these types of regulations are used widely across Europe [65]. In addition to government regulations, certification agencies such as the ASC use effluent streams as indicators with which to measure the environmental sustainability of farming operations [66].

While limiting the concentration of nutrients in effluent streams will encourage farmers to improve their utilization of aquafeeds and invest in wastewater treatment systems, it also requires structured monitoring protocols and programmes, and regulatory authorities to provide compliance services. The costs associated with setting up the water quality monitoring programmes usually accrue to the farmers. For small-scale producers that have limited resources – both financially and technically – the implementation of these types of monitoring programme are likely to prove problematical. Furthermore, such systems require government agencies to develop and invest in compliance mechanisms. While many governments in the developed world could in all likelihood afford to undertake these types of interventions, other countries with limited financial and technical resources may find them difficult to implement.

6.2.3 DISCHARGES PER PRODUCTION OR OVER TIME

In many respects, limiting effluent discharges over time or per production volume represents a similar regulatory mechanism to placing limitations on the concentration of nutrients in discharge waters. The principle difference is that the former has a temporal/production component, in that farmers are provided with discharge limits that they are not allowed to exceed in a given period of time or production volume, and the latter pro-

vides discharge limits that must be adhered to at all times. All these regulatory mechanisms require some form of verification through compliance monitoring. However, those regulations that have defined limits to discharges based on production volumes, or production volumes over time, can be assessed using simple mass balance equations and a minimal physical monitoring of effluents or production system efficiencies. For example, the ASC freshwater trout aquaculture standard [66] propose limiting the amount of total nitrogen and phosphorus discharged per tonne of production. The amount of nitrogen and phosphorus produced per tonne of trout is based on the amount of nitrogen and phosphorus content of the feed that is used, how much is removed by the filtration systems of the farms, and the production and retention rates. In terms of monitoring discharges, the only monitoring that is required is to estimate the efficacy of any filtration and disposal systems that are used. All other components of the monitoring process can be accessed from the farm records and the feed suppliers. Thus, in terms of compliance, regulating effluent discharges over time or production volume may prove easier and more cost effective for famers to implement than systems based on the continuous monitoring of effluent streams.

6.2.4 CARRYING CAPACITY OF A WATERBODY

The 'assimilative capacity' of a waterbody is defined as the ability of an area to maintain a 'healthy environment' and 'accommodate' wastes. Licensing aquaculture operations based on the 'assimilative' or 'carrying capacity' of a given waterbody provides regulators with a mechanism with which to set discharge consents, limit the number of farms/production volume in a given area, and motivate farmers to effectively manage their feed use and management practices.

With respect to the future of these types of intervention, it is probable that as the models are developed further and become more accurate, they will become increasingly important in regulating aquaculture developments. However, the current models require significant amounts of data that can be time consuming, technically difficult and costly to collect and collate. Furthermore, there can be significant variations in the carrying capacities as calculated by the various models that are currently available. Thus for the analysis to provide meaningful results, the choice and application of a given model has to be carefully considered, and must be made on the quality of the available data. As the European Water Frame Directive (WFD) [67] prompts the member states to establish River Basin Management it could be an incentive to introduce new regulation/licensing systems. This has already been established in Denmark 2012 [30].

6.2.5 BAT & BEP and its synonyms

For the purpose of this study, a vast literature research was conducted. From this research it became apparent, that in many cases BAT/BEP (or its synonyms) can be constituted in different formats. Typically, the following formats could be identified:

- BAT/BEP manuals
- Books
- Publications
- Reports
- People
    - Experts employed with producer association
    - Experts employed directly with a public authority
    - Consultants

Codes of conduct (COC), Code of Practice (COP), Standard Operating Procedures (SOP) and best management practices (BMP) are increasingly being developed to complement legal and regulatory frameworks. Such codes are self-regulatory, and typically provide guidance on specific operational procedures that are designed to ensure that the industry remains environmentally responsible and accountable. These codes can be applied at international, regional or national industry association and farmer levels. In Europe, the Federation of European Aquaculture Producers (FEAP) has developed voluntary codes of practice that broadly address feed management issues within the EU [68].

At the national and farmer association levels, some countries and industry bodies have developed specific codes of conduct and BMP.

In terms of developing BMP, facility operators are legally required to design BMP to include practices such as feed management and monitoring, effluents control, material storage, biosecurity etc.

6.2.5.1 BAT & BEP IN DENMARK

The new Danish regulation makes it possible for fish farmer to produce more fish though the regulation gives rigid limits for. A built-in incentive, of Best Environmental Practice (BEP), is to purify the effluents to levels below the regulation limits – and use the 'surplus' for farming more fish. This is normally achieved by using BAT (Best Available Technologies) for cleaning the waste water before discharging it to the river. As the name indicate – BAT is constantly improved by the industry sector producing the technology. A review in 2013 [69] considers how BAT can be applied to reduce the environmental impact of aquaculture. The Danish interpretation of BAT also includes that is shall be economical feasible for the farmer to introduce new technology to the farming process. The BAT standard requirements are described in chapter 3 and 4 in [30]**.**

The local authority shall establish conditions concerning BAT standard requirements and oxygen saturation as part of an environmental permit granted pursuant to Section 9 in the case of fish farms subject to discharge control, and an environmental permit granted pursuant to Section 12 in the case of fish farms regulated on the basis of feed consumption [30].

Production (tonnes: $\mathbf{F}_{permitted}$)	Nitrogen (kg/ton produce)	Phosphorous (kg/ton produce)	BOD (kg/ton produce)
0 – 25	42	3,2	65
25 – 55	35	2,5	35
55 – 230	28	2,1	20
> 230	27	1,4	14

Table 25 Danish general BAT-requirements for all types of freshwater fish-farms

BAT standard requirements are used to ensure that the fish-farmer has an effective utilisation of the pollutant discharge, granted by the local authority. If the freshwater fish farmer does not fulfil the BAT standard requirements, the local authority shall impose stricter requirements for treatment.

The BAT standards are assessed against the freshwater fish farmer's self-monitoring samples over a production period of one year based on the net substance input which the freshwater fish farm contributes per tonne of produced fish.

The oxygen saturation in the outlet to the watercourse must never fall below 70% oxygen saturation, except if the discharge of water from the freshwater fish farm is less than 10% of the median minimum (Q_{mm}), where the oxygen saturation must be at least 50%.

Reference is also made to the other provisions in the Order on quality requirements for aquatic areas and requirements concerning the discharge of pollutants into watercourses, lakes and the sea.

6.2.5.1.1 DESIGN & OPERATION OF FRESHWATER FISH FARMS ON DISCARD CONTROL REGULATION

Cf. chapter 3 in the statutory order, annex 1 gives specification for design and operation of freshwater fish farms subjected to the discard control regulation:

Freshwater fish farms that are regulated on the basis of requirements concerning discharge control shall submit (cf. Section 6 and Section 7) an application for an environmental permit containing information relating to design and operation. The local authority shall establish conditions concerning design and operation as part of the environmental permit, Section 9. Dispensation from the requirements in the Annex may be granted (cf. Section 8, subsection 2).

6.2.5.1.1.1 REQUIREMENTS CONCERNING DESIGN, OPERATION AND PURIFICATION MEASURES

Table 26. Requirements concerning design, operation and purification measures

Production size before write-up (Fper)	0-25 tonnes feed consumption	> 25 to ≤ 230 tonnes feed consumption	> 230 tonnes feed consumption
Pond type	NA	The pond shall consist of impermeable material, concrete or another material with similar properties	The pond shall consist of impermeable material, concrete or another material with< similar properties
Operating conditions:			
Degree of water recirculation at facilities (min. %)	NA	70[1)]	95[1)]
Retention time for water in production facilities/plant lagoons (min. hours)	4	2/12	18/36
Water flow meter (accuracy of 5%)	Yes - Water meter	Yes - Water meter	Yes - Water meter
Limited consumption of the water resource (max. l/sec.)	250 per 100 tons related feed consumption[2)]	75 per 100 tons related feed consumption	15 per 100 tons related feed consumption
Purification measures:			
Sludge basin	Yes	Yes	Yes
Biofilter	-	-	Yes
Facility for particle removal	Yes	Yes	Yes
Plant lagoon/Wetland	-	Yes	Yes
Size of plant lagoon/Wetland	-	Min. 40 m2/tons related feed consumption.	Min. 25 m2/tons related feed consumption.

1) *Degree of recirculation is calculated as follows*: 100% * (Fr – Fi) / Fr Fr = Total recirculation flow
Fi = Water intake
2) In connection with egg and fry production, the local authority may reduce the requirements concerning water consumption in order to maintain a high veterinary status

6.2.5.1.1.2 DESCRIPTION OF OPERATION, DESIGN AND PURIFICATION MEASURES

Sludge-basin
The sides and base of the sludge basin shall be made from impermeable material, so that sludge/water cannot seep out into watercourses and lakes, or seep down into the ground or groundwater. The sludge basin shall have a storage capacity equivalent to at least nine months' operation. Surplus water from the sludge basin shall be clarified before being returned to the inlet of the plant lagoon or similar purification measure with an equivalent retention time and purification effect. Between the sludge basin and plant lagoon, before the clarified sludge water is transported to the plant lagoon, one or more intermediate filters may be installed for phosphorous removal and/or nitrification and/or denitrification. The freshwater fish farmer shall be able to document the further processing of sludge through specific agreements concerning incineration, removal or similar.

Bio-filter
Dimensional requirements where biofilters are mandatory: minimum 400 m2 biofilter surface area per tonne of related feed consumption. With this minimum dimensioning, operating conditions shall be ensured via design

and operation which ensure that the specific turnover of ammonium is maintained at a min. 0.15 g NH4+-N per m2 surface area per day as an annual average. If this turnover cannot be realised, the requirement for biofilter surface area shall be increased correspondingly.

Facility for particle removal
Different types of facility for particle removal may be used.
1) Decentralised sedimentation zones. These shall be established in outlet channels with fish production or production channels made from concrete (raceways) and with facilities for the automatic extraction of sludge (sludge cones or equivalent). The sedimentation zones shall cover the entire width of outlet or production channels. The distance between the sedimentation zones shall be adapted so that particles are not sedimented outside the sedimentation zone. There must be no fish in the sedimentation zone. The decentralised sedimentation zones shall be emptied of sludge at least every two days. The sludge shall be transported directly to the sludge basin.
2) Microsieve (belt filter, drum filter or similar). The microsieve shall be installed ahead of the biological filter if one is required. The mesh size of the microsieve shall not exceed 75 µm, and the hydraulic capacity of the sieves shall not be less than the recirculation flow at the production facility. Any sludge deposits in production channels/ponds/basins shall be removed immediately.

Plant lagoon
Design requirements: The plant lagoon shall be designed as a meandering watercourse-like lagoon.

Dimensioning requirements: hydraulic load max. 0.021 litres per sec. per m2 plant lagoon. The lagoon shall have a water depth of 0.5-1 metres with an average depth not exceeding 0.9 metres. After the plant lagoon, additional purification measures may be installed, which shall not be included in the requirements for water depth and average depth.

Measurement of water in inlets and outlets
A water meter shall be installed with a logging function or equivalent instrument for measuring the water flow in all water inlets to the freshwater fish farm and all water outlets from the freshwater fish farm, so that the total water intake and water

discharge can be continuously monitored (min. measurement of water flow every 10 minutes or min. average every 10 minutes in the case of more frequent measurement).

If there is a net water loss across the facility, the water loss shall be assumed to have the same concentration as the concentration of dissolved nutrients and dissolved organic matter in the outlet water to the watercourse.

If there is a net inward seepage of water across the facility and no measurements or documentation are available which indicate otherwise, it shall be assumed that the inflowing water contains concentrations of nutrients and organic matter equivalent to the concentrations in the inlet water, if groundwater and/or drainage water is used as inlet water. If the only inlet water originates from watercourses, the concentration shall be determined on the basis of an annual analysis of groundwater/drainage water at the freshwater fish farm.

6.2.5.1.2 MAXIMUM ANNUAL AND DAILY DISCHARGES FROM FRESHWATER FISH FARMS

Cf. chapter 3 in the statutory order, annex 2 gives instructions on how to calculate maximum annual and daily discharges from freshwater fish farms subject to discard regulation.

In an environmental permit for a freshwater fish farm which is applying (cf. Sections 6 and 7) to switch from feed quota regulation to regulation based on discharge control, conditions shall be established (cf. Section 9) in accordance with Annex 2, through converting the feed quota to a maximum annual and daily discharge of organic matter measured as modified BOD, total phosphorous, total nitrogen and ammonium nitrogen.

6.2.5.1.2.1 1. DETERMINATION OF MAXIMUM ANNUAL DISCHARGE

The freshwater fish farm's net discharge (U), i.e. the discharge of a given substance (BOD, ammonium nitrogen, total N, total P) minus the content of the substance in the inlet water, shall be calculated in accordance

with: U= P - (R_N * P) = P * (100% - R_N) where R_N = The fish farm's total degree of purification R_N (%) which for the various production sizes is determined as:

Production size (F_{per})	≤ 25 tons feed consumption Degree of purification	25 to 230 tons feed consumption Degree of purification	>230 tons feed consumption Degree of purification
R_N ammonium_N	47 %	55 %	65 %
R_N total_N	50 %	50 %	50 %
R_N total P	60 %	65 %	70 %
R_N BI5	60 %	75 %	85 %

P = Production contribution of NH_4-N, total N, total P and organic matter, where the production contribution is calculated as F_{per} multiplied by the standard production contribution per ton of feed, where F_{per} is the maximum feed consumption notified pursuant to the Order on freshwater fish farming. If an environmental permit with conditions concerning a revised feed quota and other purification measures applies, these conditions shall be used as a basis for the conversion from feed quota to maximum discharge requirements.

The following standard production contribution per tonne of feed shall be used for all production sizes:

Ammonium nitrogen:	39 kg per ton of feed
Total nitrogen:	56 kg per ton of feed
Total phosphorous:	4.9 kg per ton of feed
BOD	97 kg per ton of feed

The maximum net discharge U is calculated as follows, using F_{per}

For total nitrogen, the following is used:	$U_{TN} = P_{TN} * (100\% - R_N(TN)) * 1.86$
For ammonium nitrogen, the following is	$U_{NH4\text{-}N} = P_{NH4\text{-}N} * (100\ \% - R_N(NH_4\text{-}N)) * 1.86$
For total phosphorous, the following is used:	$U_P = P_{TP} * (100\% - R_N(P)) * 1.86$
For BOD, the following is used:	$U_{BI5} = P_{BI5} * (100\% - R_N(BI5)) * 1.86$

The maximum net discharge U_{max} is calculated by multiplying F_{per} by the maximum discharge per ton F_{per}, which for the various production sizes is determined as:

Production size (Fper)	≤ 25 tonnes feed consumption	25 to 230 tonnes feed consumption	>230 tonnes feed consumption
	kg per tonne F_{per}	kg per tonne F_{per}	kg per tonne F_{per}
U_{max} ammonium_N	38.5	32.6	25.4
U_{max} total N	52.1	52.1	52.1
U_{max} total P	3.7	3.2	2.7
U_{max} BI5	72.2	45.1	27.1

6.2.5.1.2.2 CONTROL OF MAXIMUM ANNUAL DISCHARGES

In connection with the monitoring of compliance with maximum annual discharges, condition controls shall be performed for ammonium nitrogen and BOD, along with transport controls for total nitrogen and total phosphorous

6.2.5.1.2.3 CONDITION CONTROLS

As a basis for the performance of condition controls, the annual permissible maximum discharge of ammonium nitrogen and BI5 respectively shall be divided by 365 and the permissible water discharge in order to determine the discharge thresholds Uk, which must be complied with.

The condition controls shall subsequently be performed through: $d_K + k_K(n) * s_K \leq U_K$

where d_K = the average of the daily measured net concentrations in the discharge (the difference in concentrations at the outlet and the inlet for the sampling)

$k_k(n)$ = adjustment factor for condition controls for n samples. $k_k(26) = 0.5035$, $k_k(12) = .3586$ s_k = the spread of the n net concentrations in the discharges

U_k = discharge threshold (mg/l)

6.2.5.1.2.4 TRANSPORT CONTROLS

As a basis for the performance of transport controls, the annual permissible maximum discharge of total nitrogen and total phosphorous respectively shall be divided by 365 in order to determine the daily discharge thresholds which must be complied with. The discharge requirement shall be adjusted upon transition from condition control to transport control as follows:

$U_{TT} = U_{Tk} + (k_{TT} - k_k) * s_{TT}$

The transport controls shall subsequently be performed as follows: $d_{TT} + k_{TT}(n) * s_{TT} \leq U_{TT}$

where

d_{TT} = average of the net discharge on sampling days (difference in transport at outlet and transport at inlet based on measured concentrations in inlet water and water discharge and corresponding measured water volumes during the sampling day)

$k_{TT}(n)$ = adjustment factor for transport control for n samples. $k_{TT}(26) = -0.3352$; $k_{TT}(12) = -0.5205$ $k_k(n)$ = adjustment factor for condition controls for n samples. $k_k(26) = 0.5035$, $k_k(12) = 0.3586$ s_{TT} = the spread of the n net daily discharges

U_{Tk} =discharge threshold transferred directly by dividing the annual maximum permissible discharge by 365

U_{TT} = corrected discharge threshold (kg per day)

The following standard spreads s_T shall be used when calculating the adjusted discharge requirements upon transition from condition control to discharge control (n = number of samples) if there are insufficient measurement sets (minimum of 26 in one year) to calculate spreads:

Production size (F_{per})	≤ 25 tons	25 to 230 tons	> 230 tons
	n=12 and 26	n=12 and 26	n=12 and 26
Total nitrogen	0.150	0.502	2.51
Total phosphorous	0.010	0.032	0.160

Prior to insertion in:

$U_{TT} = U_{Tk} + (k_{TT}(n) - k_k(n)) * s_{TT}$

The above standard spread which is specified as a normalised value in relation to the water discharge is multiplied by the freshwater fish farm's permissible daily water discharge, so that s_{TT} is inserted in the formula as kg per day. After at least one year's measurement series, the standard spread can be replaced by the measured substance discharge from the freshwater fish farm

6.2.5.1.2.5 DETERMINATION OF MAXIMUM DAILY DISCHARGE

To determine the distribution of the annual production, the following shall be determined:

– a maximum daily discharge for total nitrogen and total phosphorous (specified in kg per day)

The maximum daily discharge U_d for total nitrogen and total phosphorous must not exceed 1% of the freshwater fish farm's total annual net discharge, i.e. U_d <= 0.01 * U (U for total nitrogen and total phosphorous respectively), where U_d must not be exceeded, calculated as a moving average over seven days.

Maximum concentrations in the discharges of ammonium nitrogen and organic matter are determined in order to prevent concentration levels downstream from the freshwater fish farm that are harmful to the fauna.

The maximum concentration Cmax of ammonium nitrogen and organic matter which must never be exceeded in the discharge is determined as follows:

- During the period April - September, the concentration in the discharges must at no time be greater than:
- Cmax = 4 * Kdis, * Qmm/Qwa
- During the period October - March, the concentration in the discharges must at no time be greater than:
- Cmax =6 * Kdis, * Qmm/Qwa

Where

C_{max} = maximum concentration of ammonium nitrogen or organic matter (BI_5) K_{dis} = discharge thresholds for ammonium nitrogen (0.4 mg/l) and BI_5 (1.0 mg/l)

Q_{mm} = the medium minimum of the watercourse immediately downstream of the freshwater fish farm

Q_{wa} = relevant water discharge from the freshwater fish farm

6.2.5.1.3 HOW TO USE BAT REQUIREMENTS

The environmental protection agency has listed a number of general BAT requirements (Table 25) as all types of freshwater fish farming must adhere to.

The level of the BAT depends on the production size, regardless if the farm is regulated on feed-quota or by effluent-control/-monitoring.

The BAT-requirement is stating how many kilos of nitrogen (N), phosphorus (P) and organic material (BOD) a fish farm maximum is allowed to emit for every 1 tonnes fish produced - based on an annual average.

Fish farms regulated by the feed-quota regulation therefore get a set of limits, they must comply with and which merges into one another:

1. Annual limits for the overall pollution the farm is allowed to emit each year – a total of kilos of N, P, and BOD annually and a daily effluent-limits as well, setting limit for the maximum daily load of kilos of N, P, and BOD daily.
2. A BAT-requirements, which says that within the total discharge, the fish-farmer now have available, he has to produce a minimum quantity of fish per discharge. In other words, the fish-farmer must make the most fish out of the pollution he is allowed to discharge.
3. Threshold. Fish-farms, being point sources of pollution, will have thresholds setting the overall limit for the environmental load accepted for the receiving water-body. This threshold is depending on the median minimum water-flow in the river (Q_{mm}) and is therefore a dynamic factor that changes over time.

Example:

If a fish-farmer wants to switch the way his farm is regulated, from feed-quota to outlet-monitoring, calculation of the amount of nitrogen (N) he will be allowed to discharge will be based on his former environment approved feed-quota ($F_{permitted}$) – in this example 29 kg N/ton fish produced. As the fish-farms original production was 150 tons/year – the farm must now observe the new limit of 28 kg N/ton produce – in other words a reduction of 1 kg N/ton production.

The fish-farmer therefore must choose a technology giving the required improvement. If reduction reached further than required by the BAT-rules, it is possible to increase production at the farm - as long as it will be within the BAT-frame (Table 25) and in respect of the Q_{mm}.

Fish-farms regulated by the feed-quota system, must also comply with the BAT requirements. The fish-farmer must incorporate cleaning arrangement/s to keep his discharge within the BAT-frames. If the result of the purification goes beyond the BAT-frame, he is not allowed to increase production – as the approval still relays on the feed-quota system.

6.2.5.1.4 DANISH FISH FARMERS PERCEPTION OF RELATIONSHIP BETWEEN ENVIRONMENTAL IMPACT AND REQUIREMENTS FOR TECHNOLOGY & PRACTICE

Table 27 Questionnaire. DENMARK. Section 4.1

4.1 Specified Code of Practice (COP) and Standard Operation Procedures (SOP)	DENMARK SEMI-RAS DISCARD REGULATED	DENMARK FLOW-THROUGH FEED-QUOTA REGULATED
a. Does portion-sized rainbow trout production follow a specified "Code of Practice" (COP) or "Standard Operation Procedures" (SOP)? Please note, that COP and SOP can relate to all activities in relation to the profession of fish farming (reproduction, production, pond management, processing, marketing, etc.).	No. The production has to follow BAT	
b. Does (freshwater, inland) aquaculture in your country follow a general COP or SOP?	No, but BAT	
c. Who is responsible for the specification of COP and SOP?	-	
d. Are they published in writing and available in full text (e.g. as a book)? Please give references and web-link, if applicable.	-	
e. How frequently are these documents updated?	-	
f. What other media are considered eligible / equivalent to COP and SOP (e.g. articles in fish farmer magazines, scientific reports, other publications)?	-	
g. Are COP and SOP used in training of staff and education?	-	
h. Are these documents legally binding (i.e. does one have to follow these rules)?	-	

Table 28 Questionnaire. DENMARK. Section 4.2

4.2. Specified mandatory technologies and practices in relation to environmental impact (BAT / BEP)	DENMARK SEMI-RAS DISCARD REGULATED	DENMARK FLOW-THROUGH FEED-QOUTA REGULATED

a. Is there a legal requirement to use certain TECHNOLOGIES and pieces of equipment in order to reduce environmental impact? For example …	For some farm types, it is mandatory to use a certain technology or another technology preforming as well as the other technology. Technologies can be brought into use to fulfil the requirements/staying within the limits for the outlet-monitoring approval Danish EPA has converted the BAT-concept to measurable values among other things based on results from the 'Model-farm-project'.	No special demand for tech. But sedimentation-ponds are mandatory for
○ Pond monk (water-level adjustment technologies, …)	Yes, pumps flow the water and the flow is automatic adjusted.	Monks and pumps for drainage of ponds, moving and grading fish
○ Aeration/oxygenation to reach a certain level of saturation before water leaves the farm again	Yes, demands is 70% saturation, but no explicit methods is prescribed.	No spec. technology, but the dissolved oxygen (O-saturation) minimum, stated in the environmental approval shall be meet
○ Biofilter, nitrification	Yes, biofilters 400 m^2 surface for each annual ton of feed	no
○ Removal of particles - e.g. sedimentation, Sludge-traps, fixed-bed filter, mechanical filtering system (drum filter/belt-filter)	Yes, demands for particle removable but no specific technology mentioned in regulation	Yes, but demands for technology on my farm
○ Constructed wetland/lagoon	Yes, 40/25 m2 per tons feed (25m2 if production is more than 55 tons/year - or is using more than 15 l/sec.	No
○ Recirculation system, RAS	Yes, trout farm model 3 must have bio-filter (dimensioned according to above)	No
○ Others (please specify)		
b. Is there a legal requirement to follow certain management PRACTICES in order to reduce environmental impact?	No, but the farmer must fill inn a logbook, and the frequency on how often to flush the sludge-cones and cleaning (flush-back) bio-filters is stated in the environmental licence - and the sequence must be recorded.	Just to remove sludge from ponds and remove sludge from sedimentation pond regularly.
○ How to manage foliage and plants near the ponds?	No demands/rules.	No demands
○ How and when to flush ponds, drains?	NA	
○ Others (please specify)	-	
c. Are these TECHNOLOGIES (typically referred to as Best Available Technology, BAT) and PRACTICES (typically referred to as Best Environmental Practice, BEP) compiled in one document?	No	

d. Do COP / SOP conflict with BAT /BEP? Please give examples.	There are no COP/SOP in Denmark	
e. Who formulates BAT / BEP (e.g. authority, authorized organization)?	The authorities.	
f. How frequently are they updated?	Not regular	
g. Do different BAT / BEP apply for NEW or OBTAIN EXPANSION permissions?	There are different levels of BAT/BEP depending on the production size of the farm.	
h. Do BAT/BEP apply regardless of thresholds (size of facility, location)?	No productions threshold	
i. What are the thresholds e.g. based on size, location, authority)?	Production threshold	
j. Are there regional differences in enforcement of BAT/BEP (yes/no/describe/examples)?	No	
k. Is there a protected "status quo" for existing farms that saves them from implementing BAT / BEP?	For one permission there is a protected period of 8 years. There after the farm has to implement new BAT when renewing the permission.	
l. Do the same "people" (authorities, institutions, associations) work together both on COP / SOP and BAT / BEP? Please give example.	For new BAT level in the rules it is mandatory for the authority to have a public hearing for new BAT levels and all other changes in the laws and rules.	
m. Do you have sufficient resources (e.g. access to finance, land, technology suppliers) in case additional BAT are requested for your farm (e.g. Would you have enough space to build a constructed wetland next to your ponds?)?	There is some financial support for investment for new and existing farms. Investment in new technology to improve water quality - with the sCOPe to increase production within the given limits for the effluent - can pay off by saving energy. You may call it BAT.	no

6.2.5.2 BAT& BEP IN GERMANY

The most direct translation of BAT would be “Gute Fachliche Praxis”

Recommendations for building and operating fish ponds, [Empfehlungen für Bau und Betrieb von Fischteichen] [41])

- Most relevant German BAT document for trout production
- Published by Bavarian authorities. Is applied not only in Bavaria, but in all other federal states as well.
- The document is pretty old (from 2001) and will be reviewed in the next 1-3 years (pers. Comm. Anon).

The first sentence of the introduction of this BAT/BEP document underlines the fact that fish ponds are part of natural water bodies in the sense of the German water law [23]. The document limits itself to pond systems (irrespective of species and size) as opposed to technical facilities which are separated from natural water bodies and in which all production parameters and environmental conditions can be fully controlled.

This is a relevant statement, because it defines a very simple albeit practical delimitation between ponds and technical facilities. Hence, there is hardly any doubt even for someone with only limited expertise in aquaculture, if he/she is dealing with a pond in this sense.

Furthermore, the document explicitly addresses (current and future) pond fish farmers, their professional associations and public authorities to provide guidance in planning and constructing of such facilities. It shall therefore serve the purpose to harmonize the (private/commercial) interests of the farmer as well as the regional cultural interest (Landeskulturelle Belange) and the requirements of water protection law.

This statement qualifies the three-fold sustainability (ecological, economic and social) sCOPe of the document and harnesses it against criticism of biased interest.

The title of the document already implies that these “recommendations” for pond construction are not touching upon current building, water and environmental law and the case-by-case evaluation of each individual construction project.

The document shall instead provide a guidance document for all the parties involved.

The term EIA is not used throughout the whole document, because by German EIA-law [40] not all fish farm operations require EIA. The EIA-law definition (see Annex 1 of the law [40]) of qualifies as:

1000 tons’ annual production: require a full-spread EIA

100 – 1000 tons’ annual production: require a general pre-assessment (allgemeine Vorprüfung des Einzelfalls: siehe § 3c Satz 1)

50 – 100 tons’ annual production: require site specific pre-assessment (standortbezogene Vorprüfung des Einzelfalls: siehe § 3c Satz 2)

Instead, the document proposed “general” or “thorough” assessment of the selected site by the environmental authorities, without specifying the exact scope of this kind of assessment.

Natural springs and sources are all protected in the federal state of Bavaria. Inlet water has to be taken from free running water, e.g. surface water rivers and streams. With reference to WFD it is noted that a complete damming or piping of free running water is not acceptable without exemption.

Same applies for flooding areas which shall be kept generally free from fish farms. The formulation implies though that under certain conditions an extensive farm operation might be eligible.

It is recommended that during site selection, potential nutrient run-off from adjacent areas into the farm/pond shall be considered. It is suggested that a pond should typically be surrounded by grassland of adequate size.

Building a fish pond can be considered an “intrusion” into the environment, which might require special assessment. In case, the effects of the intrusion cannot be avoided or mitigated on-site, other means of compensation can be required. The details are specified in the federal state law on natural preservation [44].

A fish Pond must not jeopardize the Waters bodies functionality. There at least 50% of the original Flow rate shall be maintained throughout the year. For a newly built trout Pond, at least 5l/s or in duly justified cases a Minimum of 3l/s hast to be available. Small rivers are therefore generally considered not suitable to supply a trout Pond. For all already existing farms, it is noted that the adequate effluent water quantities have to be assessed on a case by case basis. In this case, the economic viability of the farm has to be maintained as well as the functioning and biodiversity of the water body.

Recommendations for handling of fish predator’s species are given. Same for flooding areas.

Construction projects seeking financial support from EU or the federal state of Bavaria have to respect special guidelines and present adequate documentation on the application process. Both fisheries extension officers and water authorities have to be included in the application process.

A major change in a river structure, bed or shore can require assessment similar to EIA as specified in water act (Wasserhaushaltsgesetz WHG §31, [23]).

The use of water has to be acknowledged or permitted by the water authority. The required documentation and plans follow a general statute for water use issued by the authority.

It is acknowledged that the effect of the farm is dependent on the type of farm and its intensity. This has to be specified in the application.

Lengthy specifications for floral compensations are outlined. New water and land plants and trees shall fit in the landscape, existing plants and trees shall be conserved when possible.

The whole paragraph describes the fish farm as a natural recreational park with mostly work to be done as a landscape gardener. Preferably the fish farm shall be invisible.

The specification for salmonid ponds apply for the cultivation of rainbow trout, brown trout, Arctic char and other salmonids.

Inlet water should be free of or only marginally loaded/polluted; temperature in summer between 8 and 18 °C; O_2 near saturation; pH between 6.0 and 8.0; Iron less than 0.5 mg/l; free CO_2 less than 25 mg/l; Non-ionized ammonia (NH_3) less than 0.02 mg/l

It is acknowledged that the interests of other users of the same inlet water body as well as natural fish assemblages and environmental protection have to correlate. Size and type of production I frequently determined/limited by the availability of inlet water flow rate.

For a hatchery, ground or well water is needed. Ground water is preferred.

Water flow for ponds shall be sufficient for one replacement of the water volume per 48h. Ponds shall be maximally 2 m deep at the outlet point (monk) and the ground should have a tilt of 3-5 ‰. The bottom of earthen ponds shall be covered with gravel. The pond walls can be sustained with stones (Wasserbausteine), gravel or concrete. The effluent water from cleaning/rinsing the ponds needs to be treated.

Raceways are typically between 3-6 m wide (at water surface) and maximum 200 m long. They can be constructed in earth or concrete. The former are mostly suitable for rearing of stocking material. A concrete ground should be avoided. The tilt at bottom should be 3 ‰ and depth around 1 m. A minimum flow rate of ca. 3 cm/s is required. High stocking densities and strong currents can avoid sedimentation. The effluent water from cleaning/rinsing the raceway needs to be treated.

A holding system without feeding is good for the quality of the product and is therefore deemed necessary in most of the cases. It might have to be installed inside a building. The inlet water quality has to be the same as for the ponds and raceways. Effluent water from cleaning/rinsing usually has not be treated.

Ponds and slow-flowing raceways can serve as sedimentation traps. Typically, the freights of the effluent water are so low that no further treatment is deemed necessary.

Farms operating with high stocking densities and production intensities can exhibit higher freights in the effluent water. In high flow-rate raceways suspended solids are quickly transported out of the farm. In both cases, effluent water treatment of the whole effluent water flow is deemed necessary, at least during peak production phases, in order to maintain certain water quality thresholds. Typically, two techniques for doing so are available:

1. Sedimentation ponds. It is preferably to have several, smaller sedimentation ponds with a regular retention time of 30 minutes or less, when fish faeces are still well intact and sedimentation is quicker. Sludge can then regularly be removed by means of suction pumps or vacuum barrel or, after sufficient drying, by machine. The frequency of sludge removal is specified in the water permission (Wasserrechtlicher BEscheid). More frequent removal is considered favourable, because it increases security of the operation and less nutrients are re-suspended from the sludge in the effluent water. During removal of sludge, the water flow can be bypassed and effluent water can discharge without treatment. Sludge is typically used in agriculture ass fertilizer or further concentrated in a separate sludge concentration basin. From 100 l/s or above the use of a filtration system shall be considered.
2. Filtration. Microsieve filters with a mesh width of around 60 µm (e.g. triangle filter, band filter, drum filter or disk filter) are good for removal or particles that can be filtered (technical terminology, referring to a category of suspended solids that are assessed in waste water analysis, [filtrierbare Stoffe], note by the author) reducing the freight of plant nutrients like phosphorus. The wash water from the filter needs to be further concentrated e.g. by means of a sludge sedimentation basin, sludge funnel or alike. Then the sludge can also be used as agriculture fertilizer. The benefit of such a filtration is the space saving, but the high investment costs and level of technical complexity is only recommendable for larger trout farms.

Ponds might need protection against predatory birds and other wildlife animals. The specifications thereof are regulated for example in the Cormorant regulations of the federal states and in various technical documents published in professional magazines of the Bavarian fish farmers association [70, 71].

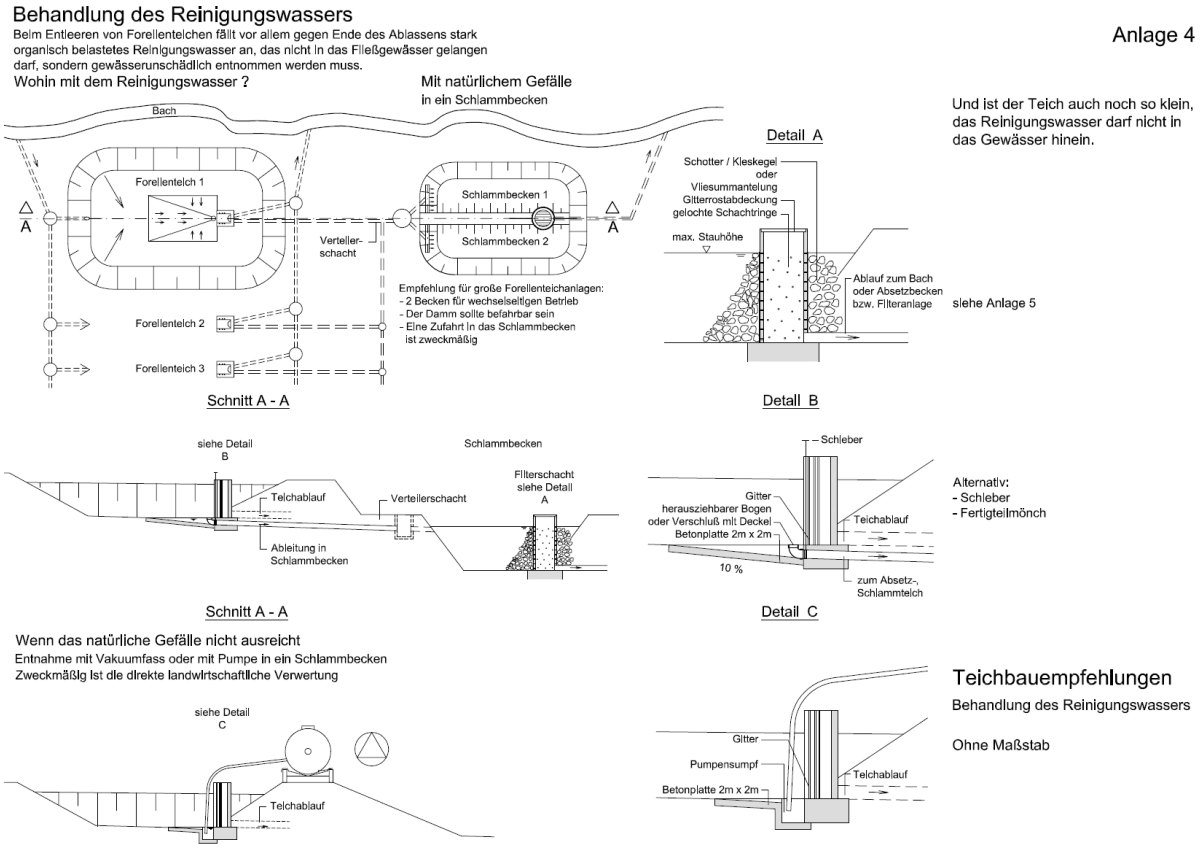

Figure 9 German recommendation for construction of sedimentation ponds

Water protection:

- Veterinary supervision and prescription is necessary for medication
- Disinfection agents shall only be applied and discharged in a non-harmful way and in accordance with safety datasheets and manufacturers guidelines
- One has to respect guideline on fish diseases [46]
- When emptying and cleaning the trout pond, the organically polluted rinsing water shall not be disposed to a natural water body
- Instead, this water shall be removed by vacuum barrel and used directly in agriculture or it shall be further concentrated in a sedimentation basin. The clear supernatant water from the sedimentation basin can be discharged
- Three intensity levels are defined:
    - They are in accordance with other Bavarian federal state laws (Bayer. Fischgewässerqualitätsverordnung (BayFischGewV) und Qualitätsansprüchen der Gewässergüte gemäß Landesentwicklungsprogramm (LEP))
    - Level I: 150 kg per l/s. Low impact. Usually no filtration or sedimentation system necessary.
    - Level II: up to 500 kg per l/s. Inlet and outlet water quality needs to be monitored by the farmer. In cases of bad feed and water management, filtration and sedimentation might be necessary. The farmer decides on the choice of the actual method/technology he wants to apply.
    - Level III: more than 500 kg per l/s. There is no upper limit on the production size under the condition that all possible means for optimizing the feed and water management are used. The actual discharge values (effluent water composition) will be higher than in level II. Therefore, site-specific thresholds have to be defined during the water permission process, in cooperation with the state fisheries advisors. The actual production intensity will then be defined by abstraction flow rate, water management and inlet water quality. Inlet and outlet water quality have to be checked/analysed 4 times a year by the farmer (see below for details on how to take water sample). A raceway typically requires sedimentation or filtration. In intensely operated ponds and slow-flowing raceways (drenches) this might be necessary as well. The farmer decides on the choice of the actual method/technology he wants to apply.

The farmer shall take appropriate measures to minimize waste water discharge and to optimize his economic and ecological potential.

- Use of environmentally friendly feed (best FCR, low protein, P-content <1,0%) and optimal rearing conditions (O_2 >7 mg/l)
- Pond cleaning/rinsing water shall be disposed in an environment friendly way (e.g. agriculture fertilizer)
- With low production intensity, effluent water can be discharged without treatment. If discharge thresholds cannot be maintained, filtration and sedimentation shall be used.
- Sufficient space for future installation of filtration and sedimentation shall be foreseen during planning
- Sludge should be removed frequently, as specified by the water permission. Farm operation specifications shall be respected in this context.

Monitoring, self-monitoring:

Self-monitoring is based on the farm operator's competencies and the specifications outlined in the water permission. All farmers have to have a farm log book, encompassing:

- Feed sourcing (per calendar or business year)
- Sludge removal (date, place, quantity, type of further processing/use)
- Use of disinfectants and medication (date, type, quantity, reason)
- For intensity level II and III farms: inlet and outlet water analysis (see annex 1)

The results of self-monitoring shall be maintained for three years, including all receipts and shall be presented to the authorities upon request.

Control by public authorities:

The communal administration and water agency is responsible for controls. The communal administration checks if the farm holds a water permission and controls, in cooperation with water agency, the self-monitoring documentation.

The water agency performs checks on site, depending on the type of farm and by their own judgement, especially in sensitive environments. It checks inlet and outlet water quality and self-monitoring of feed use and sludge removal and further sludge use. They also assess the biological condition of the water body.

Furthermore, annex 1 of this document [41] lists the following recommendations and guidelines:

Water quality assessment and thresholds in trout production

Only for intensity level II:

- Values are calculated from the difference between outlet and inlet water
- BOD-5 in raw water: 3 mg/l (DIN EN 1899-2) [72]
- Filterable matter: 15 mg/l (DIN 38409-H2-3) [73]. In water with high hardness, it can be advisable to add diluted hydrochloric acid to the sample to bring it down to pH 4. This shall dissolve calciumcarbonate crystals. In case of recent flooding, significant amounts of suspended clay can be affecting the measurement. Then no samples for filterable matter shall be taken.

The water permission authorities can adjust those thresholds according to the threat level for the related water body.

High thresholds for intensity level III shall be determined in cooperation with the fisheries advisory on case-by-case basis.

The sampling points for inlet and outlet water sampling need to be specified in the water permit.

In intensity level II there shall be 2, in level III there shall be 4 samplings per year during peak production season. The samples shall be taken as a mixed sample within 2 hours, collecting 8 samples every 15 minutes and mixing those, beginning right after feeding.

A recently published guidelines on animal welfare in fish production [74] gives “recommendations” (because it has no legally binding character) for the kind of self-monitoring of animal welfare indicators that is necessary under the new animal protection law [75].

Formblatt B1 „Wasserqualität - Salmoniden“

Haltungseinheit: _____ Fischart(en): _____ Besatz erfolgt am: _____ Ausgangsbesatz (Anzahl):_____

Lfd. Nr.	Kontrolldatum	Altersgruppe[11]	Parameter	Richtwert	Messwert	Maßnahmen zur Beseitigung der festgestellten Abweichungen	Erfolgskontrolle
			T (°C)	4 – 18		☐ Belüftung ☐ Erhöhung der Wasserdurchflussmenge ☐ Reinigung der Haltungseinheit ☐ Futterumstellung / -reduktion ☐ Sonstige:	☐ geklärt / behoben Datum: ..... ☐ nicht geklärt / behoben, weitere Maßnahmen: .....
			pH	6 – 8			
			O_2 (mg/l)	> 6			
			NH_4^+ (mg/l)	< 0,5			
			NH_3 (mg/l)[12]	< 0,01			
			NO_2^- (mg/l)	< 0,5			
			T (°C)	4 – 18		☐ Belüftung ☐ Erhöhung der Wasserdurchflussmenge ☐ Reinigung der Haltungseinheit ☐ Futterumstellung / -reduktion ☐ Sonstige :	☐ geklärt / behoben Datum: ..... ☐ nicht geklärt / behoben, weitere Maßnahmen: .....
			pH	6 – 8			
			O_2 (mg/l)	> 6			
			NH_4^+ (mg/l)	< 0,5			
			NH_3 (mg/l)[12]	< 0,01			
			NO_2^- (mg/l)	< 0,5			
			T (°C)	4 – 18		☐ Belüftung ☐ Erhöhung der Wasserdurchflussmenge ☐ Reinigung der Haltungseinheit ☐ Futterumstellung / -reduktion ☐ Sonstige:	☐ geklärt / behoben Datum: ..... ☐ nicht geklärt / behoben, weitere Maßnahmen: .....
			pH	6 – 8			
			O_2 (mg/l)	> 6			
			NH_4^+ (mg/l)	< 0,5			
			NH_3 (mg/l)[12]	< 0,01			
			NO_2^- (mg/l)	< 0,5			

Figure 10 German recommendation for self-monitoring of indicators for water quality and thus animal welfare

6.2.5.2.1 GERMAN FISH FARMERS PERCEPTION OF RELATIONSHIP BETWEEN ENVIRONMENTAL IMPACT AND REQUIREMENTS FOR TECHNOLOGY & PRACTICE

Table 29 Questionnaire. GERMANY. Section 4.1

Relationship between environmental impact and requirements for technology & practice	GERMANY FLOW THROUGH	GERMANY SEMI-RAS
4.1. Specified Code of Practice (COP) and Standard Operation Procedures (SOP)		
a. Does portion-sized rainbow trout production follow a specified “Code of Practice” (COP) or “Standard Operation Procedures” (SOP)? Please note, that COP and SOP can relate to all activities in relation to the profession of fish farming (reproduction, production, pond management, processing, marketing, etc.).	Best practice on the farm mostly for self-control: Own limit values for rearing conditions / stocking density (e.g. 100kg/m³ in the hatchery) Limit values for water flow in hatching trays. Punctual delivery as a company-standard (day, hour) High standards for fish processing (no machines, hand processing, high prices but high quality product, direct marketing)	Yes, but no written COP Voluntary: Health management Environmental awareness Vocational training for “Fischwirt” and “Fischmeister”
b. Does (freshwater, inland) aquaculture in your country follow a general COP or SOP?		
c. Who is responsible for the specification of COP and SOP?		German regulation for vocational training (“Ausbildungsverordnung”) Schools, Research Institutes

d. Are they published in writing and available in full text (e.g. as a book)? Please give references and web-link, if applicable.		Yes, but antiquated It would be important to define what is state-of-the-art for trout production
e. How frequently are these documents updated?		„Ausbildungsverordnung“ was updated the first time since 1972
f. What other media are considered eligible / equivalent to COP and SOP (e.g. articles in fish farmer magazines, scientific reports, other publications)?		
g. Are COP and SOP used in training of staff and education?		
h. Are these documents legally binding (i.e. does one have to follow these rules)?		

Table 30 Questionnaire. GERMANY. Section 4.2

4.2. Specified mandatory technologies and practices in relation to environmental impact (BAT / BEP)	GERMANY FLOW THROUGH	GERMANY SEMI-RAS
a. Is there a legal requirement to use certain TECHNOLOGIES and pieces of equipment in order to reduce environmental impact? For example …	No regulations per law. If BAT’s becomes compulsory, the government will probably not be allowed to pay subsidies for new technologies. Aeration probably not considered as BAT - maybe UV-treatment? Some are considering ASC certification as marketing strategy	Bavarian BAT („Bayerische Teichbauempfehlung“) is obsolete; will be renewed approx. in 2017; Working group from Fisheries and Water Management. The thresholds for discharge water are very low; therefore this type of farm uses intensive water treatment with biological and mechanical cleaning; some possibly additional denitrification
○ Pond monk (water-level adjustment technologies, …)		yes
○ Aeration/oxygenation to reach a certain level of saturation before water leaves the farm again	yes	yes
○ Biofilter, nitrification		yes
○ Removal of particles - e.g. sedimentation, Sludge-traps, fixed-bed filter, mechanical filtering system (drum filter/belt-filter)		yes
○ Constructed wetland/lagoon		yes
○ Recirculation system, RAS		Yes, 30-50% water exchange rate per day
○ Others (please specify)		Denitrification in 2016

b. Is there a legal requirement to follow certain management PRACTICES in order to reduce environmental impact?	No Individual decision and shouldn't be compulsory.	Denitrification to reduce nitrate in discharge water; not present in most of Europe's trout farms
○ How to manage foliage and plants near the ponds?	N/A	N/A
○ How and when to flush ponds, drains?		
○ Others (please specify)		
c. Are these TECHNOLOGIES (typically referred to as Best Available Technology, BAT) and PRACTICES (typically referred to as Best Environmental Practice, BEP) compiled in one document?		No. Website Bavarian Research Institute for Fisheries, Brochures, Other institutions or links. Fisheries consultancies of the districts
d. Do COP / SOP conflict with BAT / BEP? Please give examples.		
e. Who formulates BAT / BEP (e.g. authority, authorized organization)?		
f. How frequently are they updated?		
g. Do different BAT / BEP apply for NEW or OBTAIN EXPANSION permissions?		
h. Do BAT/BEP apply regardless of thresholds (size of facility, location)?		
i. What are the thresholds (e.g. based on size, location, authority)?		
j. Are there regional differences in enforcement of BAT/BEP (yes/no/describe/examples)?		
k. Is there a protected "status quo" for existing farms that saves them from implementing BAT / BEP?		
l. Do the same "people" (authorities, institutions, associations) work together both on COP / SOP and BAT / BEP? Please give example.		

m. Do you have sufficient resources (e.g. access to finance, land, technology suppliers) in case additional BAT are requested for your farm (e.g. Would you have enough space to build a constructed wetland next to your ponds?)?		Currently yes, but those BAT- requests would result in higher production costs and reduced competitiveness to foreign farms.

6.2.5.3 BAT & BEP IN ITALY

Even though API (Italian Fish Farmers Association) has developed COP for biosecurity, and even though Italian fish farmers know of this - it has not been possible to achieve a COPy, whereas a description of the content has not been possible.

6.2.5.3.1 ITALIAN FISH FARMERS PERCEPTION OF RELATIONSHIP BETWEEN ENVIRONMENTAL IMPACT AND REQUIREMENTS FOR TECHNOLOGY & PRACTICE

Table 31 Questionnaire. ITALY. Section 4.1

QESTIONS	ITALY
4.1. Specified Code of Practice (COP) and Standard Operation Procedures (SOP)	
a. Does portion-sized rainbow trout production follow a specified "Code of Practice" (COP) or "Standard Operation Procedures" (SOP)? Please note, that COP and SOP can relate to all activities in relation to the profession of fish farming (reproduction, production, pond management, processing, marketing, etc.).	COP, SOP, GMP Manual developed by API (Italian Fish Farmers Association), Biosecurity measures
b. Does (freshwater, inland) aquaculture in your country follow a general COP or SOP?	Yes
c. Who is responsible for the specification of COP and SOP?	-
d. Are they published in writing and available in full text (e.g. as a book)? Please give references and web-link, if applicable.	COP, SOP, GMP Manual developed by API (Italian Fish Farmers Association), Biosecurity measures (www.api-online.it)
e. How frequently are these documents updated?	More than one time/year
f. What other media are considered eligible / equivalent to COP and SOP (e.g. articles in fish farmer magazines, scientific reports, other publications)?	Fish Farmers Vademecum developed by API (Italian Fish Farmers Association), www.api-online.it web site and other specific sites developed for training
g. Are COP and SOP used in training of staff and education?	Yes
h. Are these documents legally binding (i.e. does one have to follow these rules)?	Vary case by case, this aspect is also related to the compliance with specific certification schemes

Table 32 Questionnaire. ITALY. Section 4.2

QESTIONS	ITALY
4.2. Specified mandatory technologies and practices in relation to environmental impact (BAT / BEP)	
a. Is there a legal requirement to use certain TECHNOLOGIES and pieces of equipment in order to reduce environmental impact? For example …	No
○ Pond monk (water-level adjustment technologies, …)	No
○ Aeration/oxygenation to reach a certain level of saturation before water leaves the farm again	No
○ Biofilter, nitrification	No
○ Removal of particles - e.g. sedimentation, Sludge-traps, fixed-bed filter, mechanical filtering system (drum filter/belt-filter)	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
○ Constructed wetland/lagoon	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
○ Recirculation system, RAS	No
○ Others (please specify)	
b. Is there a legal requirement to follow certain management PRACTICES in order to reduce environmental impact?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
○ How to manage foliage and plants near the ponds?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
○ How and when to flush ponds, drains?	NA
○ Others (please specify)	-
c. Are these TECHNOLOGIES (typically referred to as Best Available Technology, BAT) and PRACTICES (typically referred to as Best Environmental Practice, BEP) compiled in one document?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
d. Do COP / SOP conflict with BAT / BEP? Please give examples.	No

e. Who formulates BAT / BEP (e.g. authority, authorized organization)?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
f. How frequently are they updated?	At least every 4years
g. Do different BAT / BEP apply for NEW or OBTAIN EXPANSION permissions?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
h. Do BAT/BEP apply regardless of thresholds (size of facility, location)?	Specific requirements are laid down in the authorization measure and are fixed case by case by the competent authorities also heard the opinion of the Regional Agencies for Environmental Protection
i. What are the thresholds (e.g. based on size, location, authority)?	Fixed by Regional Agencies for Environmental Protection or River Basin Authorities
j. Are there regional differences in enforcement of BAT/BEP (yes/no/describe/examples)?	Yes
k. Is there a protected "status quo" for existing farms that saves them from implementing BAT / BEP?	YES, GMPs application is usually accepted as sufficient measure
l. Do the same "people" (authorities, institutions, associations) work together both on COP / SOP and BAT / BEP? Please give example.	Mainly Associations and consultants
m. Do you have sufficient resources (e.g. access to finance, land, technology suppliers) in case additional BAT are requested for your farm (e.g. Would you have enough space to build a constructed wetland next to your ponds?)?	Not too much

6.2.5.4 BAT & BEP IN POLAND

In Poland a codex for fish farming was developed in 2015: Fisheries Code of Good Practice in fish breeding and aquaculture [Kodeks Dobrej Praktyki Rybackiej w Chowie i Hodowli Ryb] [76]. The language differences are prohibiting further description of the recommendations in the codex. But, the organization “Pan Karp” recently (30.04.2016) issued a press release [77], announcing the implementation of a third party controlled certification scheme based on this code of good fishing practice. The further documentation and check-lists for this scheme can be found here [78].

Translated text from [77]

Code of Good Practice Fishery

- A gift for the Polish fishermen conscious consumers

Since the beginning of the second decade of the twenty-first century, the food can be seen accelerating growth in the awareness of consumers, including consumers of fish and fish products. Connoisseurs are increasingly asking not only about money but also about where it comes from fish - where it was caught or farmed, and in the latter case also we have living conditions during breeding. This interest was reflected in both the legal regulations of the European community, where more and more places in the so-called. traceability, as well as the trends to greater transparency and openness on the part of fishermen and producers.

This theme is also very present in large retail chains, where for several years, some kinds of goods are sold only with a guarantee of origin in the form of the relevant certificates. Unfortunately, the use of proven European certification schemes such as MSC, or freshwater its variations ASC not only would require payment by fishermen very high costs, but also the need to develop by foreign organizations new procedures corresponding to a very specific and unique on the European scale fish farming in earth ponds.

Given the above, Society for the Promotion of Fish in cooperation with experts from Polish aquaculture and through broad consultation on fishing environment, developed in 2012-2015 of good fishing practices, included in a document called "Code of Good Fishing in fish breeding and aquaculture". Importantly, due to the conquest of outer Polish fishermen do not suffer while any individual costs. The Code in June 2015, he was listed at number 01 on the list of codes of the Minister of Agriculture and Rural Development, and at the moment, according to the competence, is in the register of the Ministry of Maritime and Inland Navigation.

In the near future will begin call for proposals for the issuance of special certificates for fish farms, the use of the Code. This will require to meet the criteria in the following areas: formal requirements, production technology, environmental protection, health and welfare of the fish, water management and food safety.

Over the proper implementation of the certification associated with the Code will be supervised 6-person committee chaired by Prof. dr. Richard Wojda of the Warsaw Agricultural University.

Good news for fishermen are the low cost of obtaining the certificate and that most of the requirements under the certification of fishermen and so meet, leading his holding in accordance with local regulations. Already in September. it is planned to issue the first certificates for Polish farms. At the same time, the first carp and other freshwater fish from certified farms will go to trade and further to the tables of domestic consumers.

The procedures of applying for a certificate confirming the use of KDPR are presented in the section

It might be no coincidence that the above mentioned announcement of the implementation of a CoP was released just 4 days after the appeal of the organization to "major changes" in the water charge regulation system. This is a translated quote from the appeal of the organization "Pan Karp" (26.04.2016; [61]): "Therefore, we appeal to the authors of the draft Water Law, by removing the provisions introducing charges for collecting and draining water for the purpose of breeding or rearing of fish and records introducing mandatory installation unreliable in our conditions (frazil ice, leaves etc.), Impractical and very expensive new equipment to measure the amount charged and discharged waters (average of several measurement points in each object fish farming). The existing flow measurement transfers Rectangle monks inflow and outflow is in line with our water permits legal and practical in application."

6.2.5.4.1 POLISH FISH FARMERS PERCEPTION OF RELATIONSHIP BETWEEN ENVIRONMENTAL IMPACT AND REQUIREMENTS FOR TECHNOLOGY & PRACTICE

Table 33 Questionnaire. POLAND. Section 4.1

QUESTIONS	POLAND
4.1. Specified Code of Practice (COP) and Standard Operation Procedures (SOP)	
a. Does portion-sized rainbow trout production follow a specified "Code of Practice" (COP) or "Standard Operation Procedures" (SOP)? Please note, that COP and SOP can relate to all activities in relation to the profession of fish farming (reproduction, production, pond management, processing, marketing, etc.).	No official COP or SOP specified for Poland. There is a Code of Conduct for fish farming but not implemented yet among fish farms.
b. Does (freshwater, inland) aquaculture in your country follow a general COP or SOP?	Mainly yes
c. Who is responsible for the specification of COP and SOP?	One of the fish farmer's associations developed the Code of Conduct – Association of Fish Promotion, and it is responsible for the checklist/specification
d. Are they published in writing and available in full text (e.g. as a book)? Please give references and web-link, if applicable.	www.pankarprybacy.pl/Kodeks_dpr.pdf
e. How frequently are these documents updated?	Not applicable
f. What other media are considered eligible / equivalent to COP and SOP (e.g. articles in fish farmer magazines, scientific reports, other publications)?	Articles in Przegląd Rybacki, conference materials from carp and trout conferences

g. Are COP and SOP used in training of staff and education?	Yes
h. Are these documents legally binding (i.e. does one have to follow these rules)?	Recommended, but no legally binding

Table 34 Questionnaire. POLAND. Section 4.2

QUESTIONS	POLAND
4.2. Specified mandatory technologies and practices in relation to environmental impact (BAT / BEP)	
a. Is there a legal requirement to use certain TECHNOLOGIES and pieces of equipment in order to reduce environmental impact? For example …	It depends on individual Water Permit
○ Pond monk (water-level adjustment technologies, …)	water level adjustment – yes, it must be marked on water monks, etc.
○ Aeration/oxygenation to reach a certain level of saturation before water leaves the farm again	no
○ Biofilter, nitrification	not specified technically, you declare what you want to build before getting the water permission and then you need to purify the water so that not to exceed the max allowable load
○ Removal of particles - e.g. sedimentation, Sludge-traps, fixed-bed filter, mechanical filtering system (drum filter/belt-filter)	as above
○ Constructed wetland/lagoon	as above
○ Recirculation system, RAS	as above
○ Others (please specify)	
b. Is there a legal requirement to follow certain management PRACTICES in order to reduce environmental impact?	No
○ How to manage foliage and plants near the ponds?	NA
○ How and when to flush ponds, drains?	NA
○ Others (please specify)	
c. Are these TECHNOLOGIES (typically referred to as Best Available Technology, BAT) and PRACTICES (typically referred to as Best Environmental Practice, BEP) compiled in one document?	No, no such document is required
d. Do COP / SOP conflict with BAT / BEP? Please give examples.	No

e. Who formulates BAT / BEP (e.g. authority, authorized organization)?	there is no regulation such as BAT and BEP, every farm has to have GMP (Good Manufacture Practice) and GHP (Good Hygiene Practice) but that is about food safety, not environment.
f. How frequently are they updated?	Not applicable
g. Do different BAT / BEP apply for NEW or OBTAIN EXPANSION permissions?	Not applicable
h. Do BAT/BEP apply regardless of thresholds (size of facility, location)?	Not applicable
i. What are the thresholds (e.g. based on size, location, authority)?	Not applicable
j. Are there regional differences in enforcement of BAT/BEP (yes/no/describe/examples)?	Not applicable
k. Is there a protected "status quo" for existing farms that saves them from implementing BAT / BEP?	Not applicable
l. Do the same "people" (authorities, institutions, associations) work together both on COP / SOP and BAT / BEP? Please give example.	Not applicable.The Code of Conduct involves some parts relating to good environmental practice.
m. Do you have sufficient resources (e.g. access to finance, land, technology suppliers) in case additional BAT are requested for your farm (e.g. Would you have enough space to build a constructed wetland next to your ponds?)?	no, not enough space, but possible adding biofilters or oxygenation, etc.

6.2.5.5 BAT & BEP IN UNITED KINGDOM

In Scotland aquaculture has grown to be a big industry. Main production is of course marine farming of salmon, but salmon starts its life in a landbased facility where hatching, nursing and smoltification takes place. Some salmon industries grow their salmon in net cages in lochs until smoltification. On top of this, rainbow trout are also grown in marine net-cages. So, in many ways regulations, recommendations, BMP's, SOP's etc. aimed for the salmon industry actually fits, or is used by, the trout industry as well.

The salmon industry is often scrutinised by NGO's and has therefore taken the responsibility to enhance the transparency towards the market. This can be reflected in the openness on the production methods used, biosecurity responsibility, animal welfare, environmental precautionary aspects etc. – public available on the internet (e.g. https://cse.google.com/cse?cx=007197013444011456969:ll2jctu1uq8&start=0&q=SOP&oe=utf-8&sort=#gsc.tab=0&gsc.q=SOP&gsc.page=1

Also the authorities in Scotland have regulation, laws and recommendation available on the internet (http://www.gov.scot/Topics/marine/Fish-Shellfish/MGSA)

The Greenall public can access live data on biomass in sea cages and indication of treatments, seabed surveys, etc.: http://www.environment.scotland.gov.uk/get-interactive/data/marine-fish-farm/

Technical standards for finfish aquaculture in Scotland, including instruction on how to operate a land-based closed containment farm or how to moor a pen [79]

Yet another example is the 'Fish Farm Manual' presented by the Scottish Environmental Protection Agency (SEPA): http://www.sepa.org.uk/regulations/water/aquaculture/fish-farm-manual/

This manual has been produced to provide SEPA staff with detailed guidance on the legislation, policy and procedures which should be considered when regulating Scotland's marine cage fish farming industry. Although primarily an internal procedures manual, it has been made available online to help ensure that SEPA work within a clear and understandable regulatory framework. SEPA will update the manual as they develop policies and practice (in consultation with interested parties).

To give an idea on how the specifications of the license are formulated, please see template [80]. This file contains a blank template, with all the regulatory text involved and "blank" text where the specifications would be added.

Discharge statistics are published annually for each farming site in Scotland [81].

In the whole United Kingdom, certification plays an important role in the definition of BAT and BEP. Not least the greater retailers are major 'whip' in this context.

The trout industry in England and Wales has had the British Trout Associations Code of Practice for the production of rainbow trout since 1992, revised in 1995 and again in 2002. The trout industry also has its own quality standard: Quality Trout UK (QTUK) This has separate standards for farms and processing industry and is accredited by United Kingdom Accreditation Service to EN 45011 and inspected by the European Food Safety Inspection Service (EFSIS). Almost all table trout being supplied to the multiple retailers is now produced under this standard (BS EN 45011/BSI EN 45011 are criteria for technical and management competence, assessed against agreed international standards).)

6.2.5.5.1 ENGLISH FISH FARMERS PERCEPTION OF RELATIONSHIP BETWEEN ENVIRONMENTAL IMPACT AND REQUIREMENTS FOR TECHNOLOGY & PRACTICE

Table 35 Questionnaire. UNITED KINGDOM. Section 4.1

QUESTIONS	ENGLAND & WALES	SCOTLAND
4.1. Specified Code of Practice (COP) and Standard Operation Procedures (SOP)		
a. Does portion-sized rainbow trout production follow a specified "Code of Practice" (COP) or "Standard Operation Procedures" (SOP)? Please note, that COP and SOP can relate to all activities in relation to the profession of fish farming (reproduction, production, pond management, processing, marketing, etc.).	Yes, Voluntary Code of Practice; British Trout Association (BTA)	COP Scottish finfish (heavy on generic husbandry and salmon) Covers every type of production, husbandry, transport, Big overlap between both Freedom Food ISO 14001 environmental management, (e.g. energy use and monitoring at all sites, waste reduction, light bulbs. United Kingdom retailers have asked to follow this standard; symbol can be used in marketing. Global GAP RSPCA
b. Does (freshwater, inland) aquaculture in your country follow a general COP or SOP?	Yes	
c. Who is responsible for the specification of COP and SOP?	British Trout Association.	
d. Are they published in writing and available in full text (e.g. as a book)? Please give references and web-link, if applicable.	Available to BTA members.	
e. How frequently are these documents updated?	When necessary.	e.g. RSPCA, part of technical advisory group
f. What other media are considered eligible / equivalent to COP and SOP (e.g. articles in fish farmer magazines, scientific reports, other publications)?	All are useful. Some specific papers have been written or reproduced.	With SEPA and other authorities, (fish farmer's magazine out of interest). Typically, not scientific reports, but P2P-exchange. No old text books, difficult to work with!
g. Are COP and SOP used in training of staff and education?	Hopefully.	No formal qualification A lot of training internally, technical/health/ On sea sites and loch sites require more training, larger equipment, tougher environment, Husbandry training in 1st year on site a lot, on the job training COP requires specific training, qualifications, level of competence Especially true for side entrance people from other jobs

h. Are these documents legally binding (i.e. does one have to follow these rules)?	No.	

Table 36 Questionnaire. UNITED KINGDOM. Section 4.2

QUESTIONS	ENGLAND & WALES	SCOTLAND
4.2. Specified mandatory technologies and practices in relation to environmental impact (BAT / BEP)		
a. Is there a legal requirement to use certain TECHNOLOGIES and pieces of equipment in order to reduce environmental impact? For example …	No Not asking for explicit technologies You can have a rubbish system as long as you are not exceeding the water licence Quality Schemes (Quality Trout) would push the BAT not the government BAT as information important, but not for legislation. That can be dangerous! Makes too much pressure, stops thinking of people. One can do something that is more adjusted to the site and less expensive. Quality trout would be a good standard (one set of rules, one cost)	No, authorities do not care PPC (pollution prevention and control regulations by SEPA) - like processing factories, any factories that are industry Controlled activities regulations, discharge, immediate impact "Of the record encourage" to use established BATs All drum filter are form Hydrotech because we know they work Proof of efficiency, documentation can be required for SEPA SEPA want to be assured SEPA has a technical department to assess technical aspects Problem as developer: SEPA technical departments are not always fully competent, Technical department give advice to local officer.
○ Pond monk (water-level adjustment technologies, …)	No	
○ Aeration/oxygenation to reach a certain level of saturation before water leaves the farm again	No, as long as you remain within the parameters set on your discharge consent.	
○ Biofilter, nitrification	No, as long as you remain within the parameters set on your discharge consent.	
○ Removal of particles - e.g. sedimentation, Sludge-traps, fixed-bed filter, mechanical filtering system (drum filter/belt-filter)	No, as long as you remain within the parameters set on your discharge consent.	
○ Constructed wetland/lagoon	No, as long as you remain within the parameters set on your discharge consent.	
○ Recirculation system, RAS	No, as long as you remain within the parameters set on your discharge consent.	
○ Others (please specify)	No, as long as you remain within the parameters set on your discharge consent.	

b. Is there a legal requirement to follow certain management PRACTICES in order to reduce environmental impact?	No legal requirement for people to be trained Quality schemes ask for training Courses on fish farming in a school possible, but the real teaching happens on the farms	Same as technologies
○ How to manage foliage and plants near the ponds?	N/A	
○ How and when to flush ponds, drains?	No, as long as you remain within the parameters set on your discharge consent.	
○ Others (please specify)		
c. Are these TECHNOLOGIES (typically referred to as Best Available Technology, BAT) and PRACTICES (typically referred to as Best Environmental Practice, BEP) compiled in one document?	Yes	
d. Do COP / SOP conflict with BAT / BEP? Please give examples.	Hopefully not	Conflicts with customer and industry COPs Local United Kingdom retailers have their own COP, a lot are bits Copied from Freedom Food, Global GAP, QTUK (Quality Trout UK) E.g. Trading fish score: you are not allowed to crowd a fish more 2 h - trying to make it better, than 1 h Opposite effect: because of too fast crowding, difficult to point out to retailer - retailers do not understand the processes. All major United Kingdom retailer have their own individual standard - They do not accept the big certification Occasional requests to organic products....
e. Who formulates BAT / BEP (e.g. authority, authorized organization)?	BTA and Quality Assurance Schemes.	
f. How frequently are they updated?	When required	
g. Do different BAT / BEP apply for NEW or OBTAIN EXPANSION permissions?	No	
h. Do BAT/BEP apply regardless of thresholds (size of facility, location)?	No	
i. What are the thresholds (e.g. based on size, location, authority)?	None	
j. Are there regional differences in enforcement of BAT/BEP (yes/no/describe/examples)?		

k. Is there a protected "status quo" for existing farms that saves them from implementing BAT / BEP?	Not at present	
l. Do the same "people" (authorities, institutions, associations) work together both on COP / SOP and BAT / BEP? Please give example.	They should do, but probably don't. There are different organisation that come up with different COPs/BATs/etc. They should all work together, but they probably don't even speak to each other. EA and CEFAS are interested, but don't work together with Natural England. Farmers in the south are aware of the BAT from Scotland, but the customers put the pressure on the farmers.	
m. Do you have sufficient resources (e.g. access to finance, land, technology suppliers) in case additional BAT are requested for your farm (e.g. Would you have enough space to build a constructed wetland next to your ponds?)?	No.	Yes, no problem Typically easy to solve by management, smaller technical improvements Not spent major money to achieve certification- Mostly time and role.

6.2.6 COUNTRY SYNOPSIS

None of the four countries have the same perception of the term BAT – as in Denmark. Aspects of BAT or BEP can be found, but none so explicit as in Denmark.

Table 37, below, summarizing specific technical components that are mentioned in BAT/BEP references.

Table 37. Country synopsis. Questionnaire Section 4.1 & 4.2

Technology	**DENMARK**		**GERMANY**		**ITALY**	**POLAND**	**UK**	
	Discard regulated, semi-RAS	Feed-quota regulated, Flow through	Semi-RAS	Flow Through	Flow through	Flow through	England & Wales	Scotland
Following a SOP/COP	No	No	Yes	No	Yes	No (under publishing)	Yes	Yes
SOP/COP used for training	No	No	No	No	Yes	Yes	Yes	Yes
SOP/COP legally binding	N/A	-	No	No	No	No	No	No (but market-wise)
Legal requirement for technologies	Yes	No	No	No	No	No/Yes	No	No
Demand for oxygen saturation in outlet	Yes	Yes	Yes	Yes	No/Yes	No	No	-
Biofilter, nitrification	Yes	No	Yes	No	No	No/Yes	No	-
Particle removal	Yes	No (but sedimentation before outlet)	Yes	No	No/Yes	No/Yes	No	-
Demand for mechanical filters	No	No	No	Ni	No	No/Yes	No	-
Lagoon/constructed wetland	Yes	No	Yes	No	No/yes	No/Yes	No	-
RAS	Yes	No	Yes	No	No	No/Yes	No	-

6.3 COST FOR PRODUCTION

6.3.1 DIRECT AND INDIRECT COSTS OF PRODUCTION

The review has made clear that the trout sector's conflict with the (over-)implementation of environmental regulation is deeply rooted in the historical and fundamental understanding of the sectors in all five countries. Especially where both initial permission and ongoing production are directly or indirectly governed by the use of water and only to a minor extend by other metrics (e.g. energy, feed, land area, etc.), the understanding of direct and indirect costs of production is closely interlinked with the actual understanding on the use of water.

In this respect, "non-consumptive use of water" is probably the most frequently and most useful term. Free flowing water is the natural environment for raising fish. Aquaculture adds to this the confinement of a pond, raceway or a tank and the responsibility for care and welfare of the owner. The owner needs the water to make his farming operation possible, hence the access to water becomes the essential prerequisite for his business. Luckily, neither to fish nor any other activity in the farm (as long as the code of good practice is followed) destroys the water or limits its usability for anyone or anything else. Instead, the water is borrowed from the environment for the time being inside the farm. It is given back to the environment in functionally the same condition as it was taken from it. Of course, fish production like any other (animal) production causes discharges. This is just as natural as breathing and growing in any other living organism. And because aquaculture is concentrating fish growth in a confined environment, the consequences of this discharge need to be managed. The management falls under the responsibility of the farmer, because he owns the fish. So, unless he is not negatively interfering with the concept of "free flowing water" and maintains CogP, he should be free to operate. In this sense, free means literally free from direct and indirect costs, because he did not cause any undue circumstances or effects that anyone or anything else would need a compensation for.

Coming forth from this philosophical perspective, the effective implications for regulation is clear. There is no justified basis for raising any direct fees for the abstraction of water and indirect fees are very critically assessed. When the indirect cost serves the same purpose as a penalty, it usually also lacks any justified basis. When there is no harm done, there is no need for a penalty. When the cost serves the purpose to compensate for a service provided by any third party, it should be governed by the principle of "value for money". Examples for valuable services are given throughout the report and were mentioned by all stakeholders. The development of resource efficient and effective fish farming technologies is a very valuable service, as much as the investment into a self-monitoring and quality control system that increases farm operation stability and risk-mitigation. As long as quality and competence are respected, it does not matter who provides the service. I.e. it can be a contracted consultant, an employee of a public authority or the fish farmer himself.

It is beyond the scope of this study or any single person's competence to judge, if this sectoral understanding is ultimately conflicting with the principles of an outstanding example of environmental regulation, as the Water Framework Directive. But it became quite clear when we were talking to some of the stakeholders, that the basis for an open and trustful dialogue on these fundamental principles is long gone. Maybe it never existed or it was lost after another bad experience with the water permission authorities. The reservations we initially faced, but were eventually overcome by those who were willing to enter the dialogue (yes, we made extensive pre-scoping interviews in some cases), have made us aware of the potential effect of asking for such a presumably simple metric as "direct and indirect costs".

The mere metrics on the various cost categories are included in the section on regulation. The diversity of the costing models, mostly being dependent on operational metrics, environmental conditions, diverge heavily even within the national/regional scale. It was therefore beyond the scope of the present study to try to extract a representative assessment of these.

Instead, we take a reference to recent research conducted by a group of aquaculture economists on the economic performance of trout production in Europe. Unfortunately, this work is not (yet) published in peer-reviewed journals. In order to still convey the message, we are excerpting freely available, but unpublished, material from this group, in the following section.

6.3.2 ECONOMIC PERFORMANCE OF TROUT PRODUCTION IN DK & DE

Based on a "typical farm approach" within the Agri-benchmark framework, Lasner [82, 83] compared the production cost structures of rainbow trout production in Denmark, Germany and Turkey. The typical farm approach is based on a virtual dataset, that is compiled from the real economic data from numerous representative producers. Those have to be representative for their sector in terms of location, size, structure and by the way they run/manage their farm. The author focussed his research on the fattening of rainbow trout from 10g to up to 200-400g in flow-through systems. The farms were located in Germany (Baden-Württemberg and Bavaria) and Denmark (east and west coast of south and middle Jylland). The Turkish producers were located at the south-western provinces, but will not further be considered in this excerpt. In DE and DK there were each one typical organic farm defined as well. In total (DK, DE, TR) the author compared nine different farms.

The analysis of the profitability of those typical farms showed significant differences in all cost categories. The cost categories are delimited as follows:

- Opportunity costs (labour, capital, property, etc.)
- Depreciation (buildings, equipment, facilities)
- Operational expenditures (rent, maintenance, accounting, controls, licensing, consultancy, memberships, insurance, office, advertisement, feed, stocking material, veterinary services, medication, salaries, consumables, energy, oxygen, fuel, etc.)

The most profitable farm in this study was a typical (conventional, i.e. not organic) 100 to/a farm in Germany. Their total production costs were near 3.50 €/kg and a sales price near 4.20 €/kg. A similar sized 100 to/a organic farm had production costs of around 7.40 € and sales price near 6.90 €. The comparable conventional Danish systems (150, 270, 700 to/a) were very similarly group with production costs near 3.00 €/kg and sales prices just marginally above or below that. The organic 550 to/a farm had production costs near 3.90 €/kg and sales prices near 4.00 €/kg.

The point we are trying to make with this reference here becomes apparent when looking at the relative structure of the operational expenditures of the German 100 to/a and Danish 270 to/a example. Besides the "not surprising" dominance of feed and stocking material costs (DE_100: 1.74 € per 2.37 € opex; DK_270: 1.56 € per 2.52 €), the German operational expenditures contain 0.11 €/kg "other costs" as opposed to 0.20 €/kg for the Danish producer. Because of the way the data are presented in this presentation, this "other" category also contains costs that arise from licensing, certification and services in relation to regulation.

This means that a Danish producer has to spend almost double as much money per kg of his production to satisfy these external requirements. For a 270 to/a production, this means a cash difference of almost 25.000 € per year. Furthermore, this direct financial assessment does not contain any indirect costs arising from work time spend on handling those external requirements. This is probably one of the most difficult metrics to assess, especially in light of the high degree of job profile diversification as discussed in another section in this report. An approximation is provided when looking at the relative productivity of the farms. The physical productivity is defined as the proportion between kg of live weight produced divided by the total man-hours spent. In this benchmark, the German 100 to farm excels at more than 160 kg of production per man-hour, whereas the Danish 270 to farm achieves only half of this, near to 80 kg per man-hour. It is beyond our knowledge to judge on the many potential causes for this discrepancy. But under the assumption that both farmers were competent in running in their farm and were using somehow state-of-the-art production technology, there is an indication for the diverse workload that a Danish farmer has to manage. Please note, that these results are not affected by the different gross salaries in the two countries. When breaking the same metric down to financial turn-over per labour costs, the Danish (near 26 €/h gross salary) farm performs 5-times worse than the German (near 16 €/h gross salary) farm. It is obsolete to mention that the Turkish production cost (in a 500 to/a unit) ranged near 1.60 €/kg with operational expenditures of 1.51 €/kg and "other costs" of 0.06 €/kg. Despite a low productivity (near 35 kg/h) and a sales price around 2.00 €/kg, the low salary costs (3.06 €/h) made this farm profitable.

This example shows that the typical farm approach (and agribenchmark in general) could have the potential to provide a scientifically sound data collection and interpretation framework for the assessment of economic

performance of trout production in different countries. Further research[2] and data collection specifically pertaining to a more detailed differentiation of "other costs" in relation to environmental regulation is needed.

[2] http://www.agribenchmark.org/fish/country-sector-and-farm-information/trout-production.html

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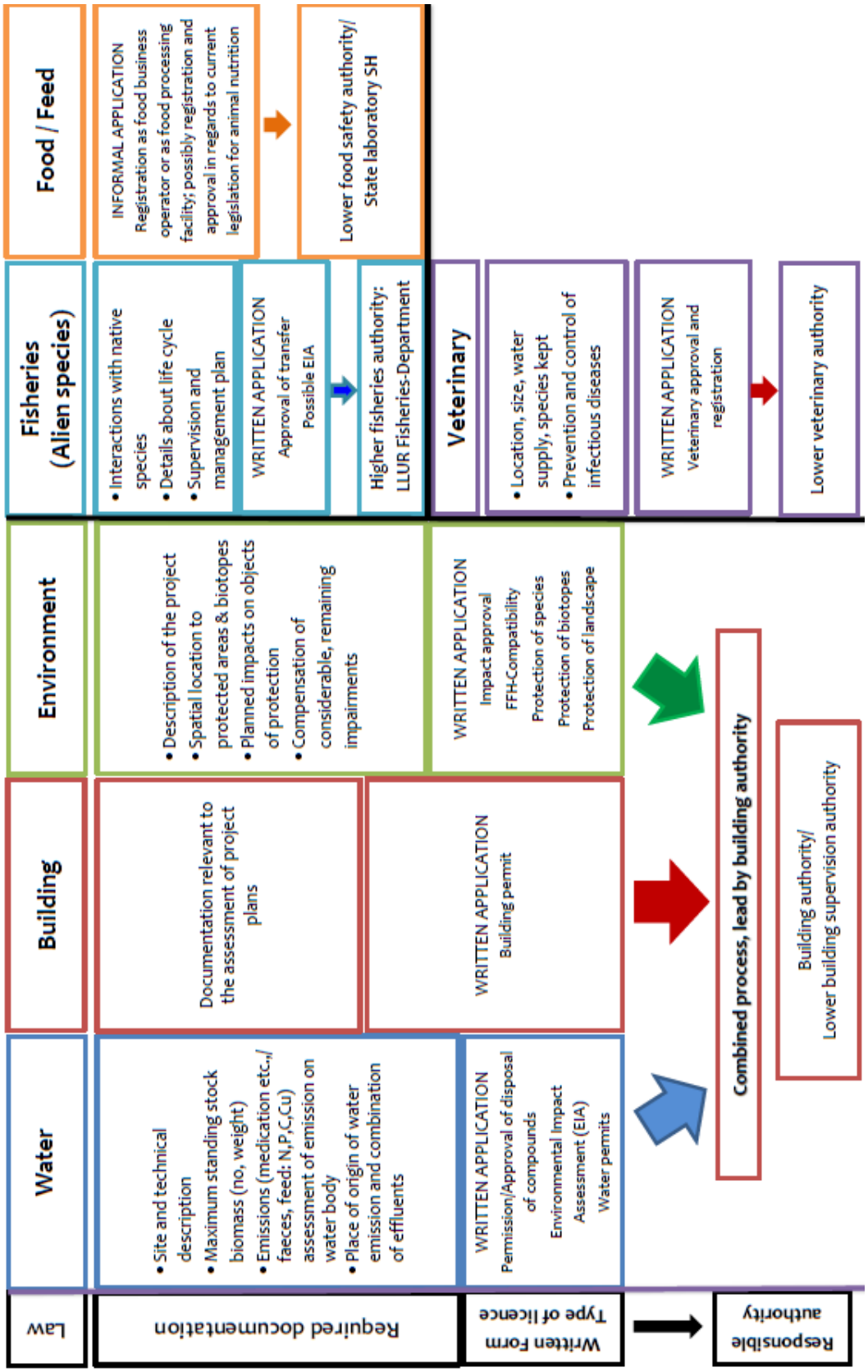
8 APPENDIX: FLOW DIAGRAM LICENSE GERMANY

Figure 11 Flow diagram license Germany (federal state Schleswig-Holstein)

(adapted from MELUR, http://www.schleswig-holstein.de/DE/Fachinhalte/F/fischerei/aquakultur.html)



Comparison of legal regulation and technology level requirements, for aquaculture facilities producing rainbow trout in freshwater, in selected European countries

This report presents the current practice with regard to legal regulations and the level of technology used in the farming of freshwater portion-sized rainbow trout in a number of EU-member states (DK, DE, IT, PL, UK). Special reference is taken to the use of Best Available Technology (BAT) and Best Environmental Practice (BEP). These technical terms, frequently used in other (industrial) contexts, are now very relevant to aquaculture practices. Emphasis is also placed on the structural differences in permission seeking and licensing processes as well as the implementation of self-monitoring obligations.

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