

Cefas contract report < C6078 >

Title: 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

Part 2 Annexes & supporting documents

Authors: Jeffery, K.R., Vivian, C.M.G., Painting, S.J., Hyder, K., Verner-Jeffreys, D.W., Walker, R.J., Ellis, T., Rae, L.J., Judd, A.D., Collingridge, K.A., Arkell, S., Kershaw, S.R., Kirby, D.R., Watts, S., Kershaw, P.J., and Auchterlonie, N.A.

Issue date: 10th December 2014

Cefas Document Control

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Quality control by:	S. Irving
Approved by & date:	7.11.14.
Version:	6.0

Version Control History			
Author	Date	Comment	Version
Auchterlonie	30/06/2014	First draft	1.0
Auchterlonie	15/08/2014	Addressed Commission comments	2.0
Auchterlonie	19/09/2014	Addressed Commission comments	3.0
Auchterlonie	17/10/2014	Addressed Commission comments (Water Unit), comments raised at BXL workshop #2 (29/09/2014), and stakeholder comments	4.0
Auchterlonie	10/11/2014	Addressed comments from DG ENV/MARE raised at	5.0

		a meeting on 23/10/2014	
Auchterlonie	10/12/2014	Addressed comments from DG ENV/MARE by email (dated 25/11/2014) and completed stakeholder comments	6.0

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Acronyms

AA	Appropriate Assessment	GFCM	General Fisheries Council for the Mediterranean
ARAD	Areas for Regulated Aquaculture Development	H2020	Horizon 2020
AZA	Allocated Zone for Aquaculture	HELCOM	Helsinki Commission
AZE	Allowable Zone of Effects	IAS	Invasive Alien Species
BEP	Best Environmental Practice	ICES	International Council for the Exploration of the Sea
BIM	Bord Iascaigh Mhara (Irish Sea Fisheries Board)	ICZM	Integrated Coastal Zone Management
BOD	Biological Oxygen Demand	IMTA	Integrated multi-trophic aquaculture
BQE	Biological Quality Elements	JRC	Joint Research Centre of the European Commission
BS SAP	Black Sea Strategic Action Plan	MA	Marketing Authorisation
CAQ	Committee on Aquaculture	MANPs	Multi-Annual National Plans
CAR	Water Environment (Controlled Activities) (Scotland) Regulations 2011	MRL	Maximum Residue Limit
CLAMS	Co-ordinated Local Aquaculture Management System	MS	Member State(s)
CFP	Common Fisheries Policy	MSFD	Marine Strategy Framework Directive
CVMP	Committee for Medicinal Products for Veterinary Use	Natura 2000	Network of SAC and SPA sites
EAS	European Aquaculture Society	N	Nitrogen
EATiP	European Aquaculture Technology and Innovation Programme	NGO	Non-Governmental Organisation
ECASA	An Ecosystem Approach to Sustainable Aquaculture	NIS	Non-Indigenous Species
ECOPACT	Environment Management System for Aquaculture	nm	nautical mile
EEA	European Environment Agency	OSPAR	Oslo and Paris Conventions (of European Governments) protecting the North-East Atlantic marine environment
EF	Environmental flow	P	Phosphorus
EFARO	European Fisheries and Aquaculture Research Organisations	PARCOM	Paris Convention for the Prevention of Marine Pollution from Land-Based Sources
EIA	Environmental Impact Assessment	PASM	Areas of Informal Concentration of Units
EIHA	Environmental Impacts of Human Activities	PAY	Aquaculture Development Areas
EQR	Ecological Quality Ratio	PE	polyethylene
EQS	Ecological Quality Standard	POAY	Areas of Organized Development of Aquaculture
ETPs	European Technology Platforms	RAC/SPA	Regional Activity Centre for Specially Protected Areas
EU	European Union	RAS	Recirculation Aquaculture System
EU-28	Member States of the EU	RBSP	River Basin Specific Pollutants
FM	Fishmeal	SACs	Special Areas of Conservation
FCR	Feed Conversion Ratio	SBM	Single Bay Management
FWFD	Freshwater Fish Directive	SEA	Strategic Environmental Assessment
GES-MSFD	Good Environmental Status – Marine Strategy Directive	SEPA	Scottish Environmental Protection Agency
GES-WFD	Good Ecological Status – Water Framework Directive	SMEs	Small and medium enterprises
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection	SPAs	Special Protection Areas
		SWD	Shellfish Waters Directive
		ToR	Terms of Reference
		VICH	Veterinary International Conference on Harmonization
		WB	Water Body
		WFD	Water Framework Directive

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Annex 1: Minutes of the First Brussels Workshop, 6th March 2014

Project: Background Information for Sustainable Aquaculture Development, addressing in particular good practice in environmental protection, and implementation and transposition of the WFD and MSFD

Stakeholder Workshop #1: Brussels

Venue: Maison des Associations Internationales – MAI, Rue Washington, 40, Brussels

Date: 6th March 2014

Workshop Minutes

Workshop Panel/Facilitators:

- **DG ENV:** Nigel Smith
- **DG MARE:** Anna Zito
- **Cefas:** Neil Auchterlonie; Keith Jeffery; Kieran Hyder; Simon Kershaw

Session 1: Welcome and introduction (DG ENV/DG MARE)

- Nigel Smith (DG ENV) and Anna Zito (DG MARE) welcomed the participants to the workshop.
- The driver for the guidance document is the need for sustainable development of aquaculture that strikes a balance between supporting the development of the sector and ensuring a the protection of the marine environment.
- The approach is similar to previous guidance on aquaculture and Natura 2000 [1], and is to develop guidance based on understanding the environmental impact of the sector and the challenges faced in implementing existing legislation (WFD and MSFD in particular). This work will not change legislation, rather is aimed at sharing information and best practice to help implement legislation as efficiently and effectively as possible.
- The project needs to utilise the knowledge of all stakeholders including regulators, industry, scientists, policymakers, and NGOs in production of these best practice guidelines.

Session 2: Summary of the project (Cefas)

- Neil Auchterlonie outlined the project objectives, deliverables and timeline, and introduced members of the Cefas project team providing presentations and facilitating the workshop.
- The overall aim of the project is to develop guidance for the sustainable development of European aquaculture in relation to the WFD and the MSFD. To achieve this, a review of the existing literature will be undertaken and examples of good practice will be collated;
- Feedback from stakeholders will be collated at 2 Brussels and 4 regional workshops. Examples of implementation by MS, good practice, and potential impacts will be collected and incorporated into the guidance documentation;
More information is available at www.euaquaculture.com.

Session 3: Guidance document: (Keith Jeffery, Cefas)

- The aims and approach taken so far in developing the guidance document were outlined.

- A summary of initial findings had been circulated in advance of the workshop to participants and were outlined in more detail in Sessions 4 – 10 below.

Session 4: WFD & aquaculture (Neil Auchterlonie, Cefas)

- The interaction between aquaculture and the WFD was outlined.
- A description of the WFD in relation to classification schemes; the role of the RBMPs, Programme of Measures, and Competent Authorities was presented;
- The inclusion of the obligations of the repealed instruments (Shellfish Waters Directive and Freshwater Fish Directive) within the WFD was covered;
- Hydromorphological, physico-chemical and biological quality, and the impacts of aquaculture in relation to these factors, and the fact that the impacts of aquaculture would be very much related to the aquaculture system type (and species) was covered;
- Descriptions of the key issues were presented as follows:
 1. Discharges – water quality parameters of the discharged water; distance from point of abstraction to point of discharge;
 2. Flow management, and how water flow changes may alter hydromorphology at the catchment level;
 3. Protection of water quality - relevant elements and parameters need to be identified, e.g. dissolved oxygen, phosphorus and nitrates;
 4. Containment effects, escapees, pathogens – identification and justification of which are ‘pollutants’ or alien species;
 5. Ecological continuity – e.g. do changes in hydromorphology allow free passage of migratory fish, or exchanges of water with adjacent water bodies?
 6. Biodiversity – multiple examples, including protection of predators (cormorants, otters) in comparison to aquaculture needs; creation of habitats (due to retention of water, e.g. wetland systems);
 7. Species introductions – introducing new species for aquaculture; restocking – issues under Invasive Alien Species Regulations
- Noting the importance of standardisation of the implementation of WFD across EU MSs, and how there are drivers for aquaculture development through CFP Reform and Blue Growth;
- Regulatory examples of the implementation of WFD in relation to aquaculture were provided, drawing from the situation in the UK (at this stage of the project). These included:
 1. Description of the Competent Authorities in Devolved Administrations in the UK;
 2. Permits required for abstraction and discharge;
 3. Licensing of medicines and other compounds requiring discharge consents;
 4. Regulation in other areas such as fish and shellfish health, that may have benefits in relation to the objectives of the WFD (e.g. managing risk of invasive alien species).
- Suggestions were made to include discussion of the Regional Seas Conventions and look at regional adaptations that have already been developed (e.g. AQUABEST in the Baltic). Regional working groups also need to be considered (e.g. GFEM).
- There were further questions about whether some regions could support any increase in aquaculture production, as any increase could have a significant impact on the system – the point was made by some that in ecological terms the sea had appeared to have reached its carrying capacity;

Session 5: SWD and stakeholder concerns (Simon Kershaw, Cefas)

- The Shellfish Waters Directive (SWD) was presented as a recently repealed legislative instrument for European shellfish aquaculture. Since the repeal of the SWD, protection of shellfish waters in the EU has been subsumed into the WFD (and MSFD).

- The majority of current EU shellfish aquaculture occurs inshore (within the limits of the WFD), however offshore shellfish aquaculture may increase in the future and therefore protection offshore under the MSFD also needs to be considered.
- The WFD is expected to deliver at least the same level of protection to shellfish waters as the repealed SWD.
- Both WFD and MSFD have broadly similar approaches and objectives to the repealed SWD: to enable healthy, diverse and productive waters for shellfish aquaculture, and therefore EU shellfish aquaculture should benefit from appropriate implementation of the WFD, if water quality is improved/maintained.
- However some shellfish aquaculture stakeholders remain concerned by the repeal of the SWD (e.g. by the loss of a stated microbiological standard), and the implementation of the WFD and MSFD (e.g. likelihood of some forms of shellfish aquaculture being perceived as a risk to achieving Good Ecological Status in certain areas).
- In general, the stakeholder priorities for developing shellfish aquaculture post-SWD draw many parallels with the main aims and objectives of the WFD and MSFD.
- It was noted that any cost-benefit measures will need to be applied by MS, so it would be useful to have examples of their application to learn from examples and develop good practice.
- The role of shellfish aquaculture in provision of ecosystem services (e.g. carbon sequestration) was highlighted.

Session 6: Freshwater Fish directive (Neil Auchterlonie, Cefas)

- The presentation covered the repeal of the FWFD, and its replacement by the WFD in December 2013, the minimum standards for a set of parameters – trace metals, organic contaminants, nutrients, temperature, pH and biological oxygen demand (BOD), the required separate designation of waters suitable for salmonids (salmon, trout, grayling & whitefish) and coarse fish (pike, perch, eel);
- Equivalent features of the WFD were covered, in relation to the definition of Good Ecological Status (GES) including all the physio-chemical parameters included in the FWFD, and ‘Fish’ as a biological quality element included in the WFD, so achieving GES will ensure sustainable populations of indigenous fish;
- In addition it was noted that WFD applies to all natural waters, not only those formerly covered by the FWFD;
- The Hungarian Fish Producers Association representative referred to their organisation’s book presented at the workshop (along with a series of photographic images of wildlife taken at Hungarian fish farms) showing positive impacts of pond aquaculture;
- There are a number of economic studies that assess the value of pond production and other ecosystem services.

Session 7: MSFD & aquaculture (Kieran Hyder, Cefas)

- The background to the MSFD was outlined including the scale of application and overall aims, and the proposed timelines for delivery by each MS were described. The key point is that the MSFD sets a framework to achieve Good Environmental Status by 2020, but cannot achieve this alone - its implementation is complementary to a number of other policy instruments, (e.g. the reformed Common Fisheries Policy, the Water Framework Directive, the Habitats Directive etc.).
- The three potential interactions between aquaculture and MSFD are:
 1. The level of interaction will depend on the scale of the impact (i.e. regional), geographical scope (i.e. location relative to the coastline), potential mitigation from existing legislation (e.g. alien species), and the potential growth of aquaculture over the period to 2020. Non-indigenous species could be an exception and voluntary codes of practice may be required.

2. Impacts of MSFD on aquaculture: one example could be that the reduction in litter and contaminants driven by MSFD could help aquaculture.
 3. Impacts of aquaculture on MSFD: aquaculture may reduce pressure on wild fish stocks; conversely, catching smaller wild marine species to serve as feed on aquaculture farms could hamper attempts to reach compliance with Maximum Sustainable Yield and Descriptor 3 of the MSFD..
- The recent EC report on the first round of MSFD implementation (COM (2014) 97 final) will be assist in assessing the potential impact of aquaculture.
 - There was discussion about the need for application of the precautionary principle in the implementation of the MSFD and that this must be addressed in future documentation. The need for examples of best practice from all areas of Europe.

Session 8: ASR regulation within WFD & MSFD (Keith Jeffery, Cefas)

- The interaction between aquaculture and the Alien species regulation was outlined. Invasive alien species are a growing concern and threat to global biodiversity. The EU biodiversity strategy aims to reduce the impacts from IAS. Regulation for aquaculture is already well developed with permits and risk assessments under framework 708/2007 & exemptions from permitting for closed systems under 304/2011.
- New alien species legislation currently in draft covers a wide remit and will establish a framework based on prevention, early detection, rapid eradication and management.
- EU projects such as PREVENT ESCAPE have provided further recommendations and the industry codes of good practice are being developed and will become important in mitigation strategies.
- Alien species were not part of core WFD text but further work has supported inclusion and subsequent work has been around Identification and risk assessments.
- The presence of Alien species in a catchment may affect Good Ecological Status or Good Environmental Status.
- MSFD explicitly covers IAS under descriptor 2 and technical indicators laid out in Commission Decision 2010/477/EU. These can be further refined, in light of the Commission's report on the first round of MSFD implementation, to focus on the reduction of risk of introduction, surveillance indicators and specific management plans for high risk species.
- Examples of good practice were briefly presented on both regulations (E&W ASR regulation) and sectoral good practices (Bangor mussel producers association – code of good practice)

From the audience the following comments were taken:

- Aspects of climate change need to be accounted for in the development of aquaculture (e.g. biogeographical ranges of fish, spawning implication).
- Inter-regional plans may have an impact on each other as there are interactions between the regions
- It was noted that MSFD applies at the regional scale. A recent paper focuses on trends on marine aliens and their pathways (e.g. shipping canals) shows some residual risk from aquaculture.
- Ornaments also need to be considered as these can enter watercourses due to flooding.

Session 9: Blue growth using EIA & SEA (Simon Kershaw, Cefas)

- SEA Directive 2001/42/EC provides the framework. Strategic Environmental Assessment (SEA) looks at similar plans or programmes in a region and is used as a planning tool. The use of SEA for aquaculture is not routine, examples found include the location and re-location of fish farms in Scotland, and to identify suitable locations for aquaculture in Ireland and South Africa.
- Environmental Impact assessment (EIA) under Directive 85/337/EEC is a method to systematically assess the likely impacts of a proposed project and the options for reducing these effects. Projects in Annex I require mandatory EIA, projects in Annex II require a decision by

authorities as to whether project needs an EIA. The only reference to aquaculture is listed in Annex II as Intensive fish farming.

- Using the UK as an example there are numerous existing pieces of national legislation which can be confusing for developers. The definition of intensive fish farming is not clear.
- The use of EIA for aquaculture is more routine. However, inconsistencies with application in different countries were identified. These included different thresholds, terminologies and approaches.
- Appropriate Assessment may be required under the Habitats Directive near to, or in, a Natura 2000 site. SEA/EIA & AA can run concurrently and have similar information requirements.
- AAs are binding – if competent authority determines significant effect, project cannot proceed.
- SEA/EIA is not binding but informs permitting decisions.
- There is a need to address the cumulative effects of aquaculture, and the guidance should draw on existing documentation. Greece applies a licensing system for SEA & EIA and marine spatial planning requires SEA. Guidance on Audits and Footprints is being developed and examples are required to test this guidance.
- The need for aquaculture production to grow sustainably is highlighted by the Food & Agriculture Organisation (FAO). Europe has best aquaculture security and safety in the world and this needs to be publicised widely.

Session 10: Proposed structure of guidance document (Keith Jeffery, Cefas)

A template structure of the final guidance document was developed from the initial literature search and this was put forward for discussion by the stakeholders.

- It was highlighted that all sectors need to comply with legislation, not just aquaculture, and this needs to be stated clearly in the introduction to the guidance.
- The aquaculture sector is broad, so it will be difficult to produce a single guidance document that covers all sectors. Examples of good practice will need to be identified that come from all parts of the sector and different regions.
- A breakout session was run to seek feedback on the structure of the guidance document. The outcome from the breakouts was compiled by themes in the guidance document (see below).



Brussels - Flip chart -
Break out 1- guidance

- The suggestions regarding the approach and structure of the guidance document that have been included in an updated template that is being reviewed by the EC.

Session 11: Literature review (All, Cefas)

- The content of the initial literature review were provided in advance of the workshop, and copies were given to each participant that included a feedback form.
- It was not possible to complete the breakout group due to time pressures, so agreed to take feedback on the form provided by the end of March 2014 (see below).



Aquaculture_Feedback_Form.docx

- Cefas has requested feedback from stakeholders on any additional literature by the end of March 2014. This will be collated into an updated inventory of literature by the end of April 2014.

Session 12: Summary of morning session (Neil Auchterlonie, Cefas)

- A brief summary of the morning session and outline of the afternoon session was provided.

Session 13: Good practice workshops (Neil Auchterlonie, Cefas)

- There will be four regional good practice workshops:
 1. North East Atlantic (Dublin Castle, Dublin: 10th/11th April)
 2. Mediterranean (Ministry of Environment, Energy and Climate Change, Athens: 5th/6th May)
 3. Danube/Freshwater/Black Sea (Vienna International Centre, Vienna: 20th/21st May).
 4. Baltic (date and location to be confirmed, but likely to be in June 2014).
- It was noted that the Vienna date clashed with the FEAP AGM. New dates have since been arranged as 20th/21st May;
- The proposed structure of good practice workshops was outlined;
- Breakout groups were used to seek feedback on what is considered good practice both in terms of mitigating environmental impact and also in implementation of WFD legislation. The outcome from the breakouts was compiled by theme (see below);



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- The suggestions regarding the approach and structure of the guidance document have been included in a revised version.

Session 14: Process management (Kieran Hyder, Cefas)

- The process for delivery of the guidance document and how stakeholder input will be obtained was outlined. A number of ways of providing feedback were outlined:
 1. Online consultation via the website –<http://www.euaquaculture.com>.
 2. Regional workshops (including breakouts and feedback forms).
 3. Brussels workshop (including breakouts and feedback forms).
 4. Consultation on the draft guidance document.
- A breakout session was then run to address the following questions:
 1. How should we best facilitate consultation?
 2. How can we maximise the exchange of information?
 3. What tools already exist to communicate?
 4. What else have we missed?
- A summary of the outputs from the breakout groups is provided in the document below.



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- The suggestions regarding the approach and structure of the guidance document that have been included in an updated agenda for each of the workshops.

Session 15: Closing address (Cefas, DG ENV & DG MARE)

- The participants were thanked for their time and input into the development of this guidance document.
- The delegates had produced many examples regarding the economic contribution and environmental concerns surrounding aquaculture.
- DG ENV would like to hear more from MS representatives regarding information gaps, and their needs, and DG actions that would help them with implementation of WFD and MSFD in relation to aquaculture. This will be picked up in the regional workshops.

References

- [1] European Commission (2012). Guidance on Aquaculture and Natura 2000. Sustainable aquaculture activities in the context of the Natura 2000 Network Environment
- [2] European Commission (2014). Reporting on the first phase of MSFD implementation: http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/implementation/reports_en.htm

Annex 2: Minutes of the North East Atlantic Regional Workshop (Dublin)

Project: Background Information for Sustainable Aquaculture Development, addressing in particular good practice in environmental protection, and implementation and transposition of the WFD and MSFD

Regional Workshop 1: NE Atlantic

Venue: Dublin Castle, Dublin, Ireland

Date: 10th and 11th April 2014

Day 1-Thursday 10th April

Welcome and Introduction

Cian Ó Lionáin (DECLG) welcomed the participants to the workshop. He praised the initiative by DG ENV/MARE on the joined up approach with participants in their efforts to implement the requirements of the WFD and MSFD, in relation to the development of sustainable aquaculture. The quality of the freshwater and marine environment is critical for the growth of aquaculture, and the driver for the Commission guidance document is the need for the sustainable development of aquaculture that strikes a balance between food security and protection of the marine environment.

Eoin Mac-Aoidh (DG MARE) explained that the project is sponsored by DG ENV and DG MARE. Aquaculture is an important subject within the reformed Common Fisheries Policy (CFP). Only 10% of EU consumption is currently from EU aquaculture, 25% from EU capture fisheries and the remainder of finfish and shellfish consumption is imported from outside the EU. These statistics suggests that demand is greater than supply and there is great potential to expand aquaculture production in the EU to meet the demand, improve food security and improve the economy. Guidance is necessary for expanding aquaculture sustainably within the remit of the WFD and MSFD, therefore stakeholders are invited to speak and engage in discussions which will contribute towards production of the Commission guidance document.

Neil Auchterlonie (Cefas) introduced members of the Cefas project team providing presentations and facilitating the workshop. He outlined the project aims, objectives and timeline. The 9 month project started in December 2013 and was being conducted by Cefas (an Executive agency of Defra). The overall aim of the project is to develop a background document on environmental legislation (especially WFD and MSFD) in relation to the sustainable development of European aquaculture. To

achieve this, a review of the existing literature will be undertaken and examples of good practice in both aquaculture and the implementation of the legislation will be collated from available information and stakeholder consultation across EU-28.

Feedback from stakeholder consultation and engagement with MS administration level, some industry and NGOs, will be collated from two Brussels meetings and four regional workshops held in Dublin (NE Atlantic region), Athens (Mediterranean region), Vienna (Freshwater, Danube and Black Sea region) and Copenhagen (Baltic region). The purpose of the workshops will be to share and collect information on examples of good practice and issues with the implementation of MSFD and WFD by MS, the good practice examples will be considered when writing the background document. The workshops will also be used to consult on criteria for good practice. Further information on the project is available at www.euaquaculture.com.

The approach to be taken for this background document is similar to previous guidance on aquaculture and Natura 2000 [1], and will help develop guidelines for the implementation of existing legislation across Member States (MS), based on understanding any potential impacts and how to mitigate them for the sustainable development of aquaculture. This work will not change legislation, rather it is aimed at sharing information and good practice within the aquaculture sector to help implement legislation (without undue administrative burden) while ensuring adequate protection of the environment.

The project needs to utilise the knowledge of all stakeholders including regulators, industry, scientists, policy makers, and environmentalists to produce the good practice guidelines so engagement and participation is encouraged from all these sectors.

Session 1 Good practice examples: how to improve environmental performance in practice

Speaker 1: James Wilson (Deep-dock Ltd.)

Code of good conduct for mussel seed movements.

Mr Wilson described his presentation as relevant to the MSFD, especially Descriptor 2, concerning alien species. A code of good practice for mussel seed movements was implemented by the Bangor Mussel Producers Association to prevent the introduction of certain invasive non-native species (INNS) into the Menai Strait during the translocation of juvenile mussel seed. Drivers to introduce

the code were commercial, legislative and environmental. Introduction of a code of good practice was successful in this example as it allowed industry to participate in the measures which ultimately affected them, it is an efficient and effective way to control this specific issue, and is good value for money with industry contributing directly to implementing the code. Codes such as these can sometimes be seen as additional layer of bureaucracy, so it is essential that local industry buys into the code and that its use becomes widespread in the sector, rather than being voluntarily adhered to by only some individuals. It is essential that the content of any code of good practice is clear, concise, current and functional. Industry funded research by academic experts (from Bangor University, North Wales) enabled the code to be developed and applied with an understanding of particular INNS species, and also enabled identification (and addressing) of knowledge gaps. The code applies to certain species which are known to be already established in the environment near/where mussel seed is collected.

Speaker 2: Dave Jackson (Marine Institute)

The Irish approach to sea lice management.

Dr. Jackson explained that it is recognised that in Ireland there has been a long term decline in Atlantic salmon stocks, with many reasons suggested including temperature changes and sea lice infestation. To address the problem of sea lice, a national sea lice monitoring and control programme is enforced in Ireland, with each licensed fish farm receiving a minimum of 14 inspections per annum carried out by the Marine Institute, as part of their formal licence condition. Each year class is inspected from one standard pen and one random pen. The results are communicated to the farm within 5 working days, and monthly reports are provided back to the relevant government departments and interested parties. All results and trends are published annually, with both raw data and analysis to put results in context. Single Bay Management in Ireland is an example of best international practice where all fish farm activities (e.g. treatments, fallowing, single generation) are managed and coordinated across several farms sites in a single bay/area. The CLAMS process and DAFF Pest Management Strategy May 2008 were also mentioned in the context of coordinated strategies. The establishment of a local working group around farms in a bay helped establish a holistic approach with vets, regulators and other farms in the area reviewing medicines use and treatment regimes. This increased availability of well boats, and general advice in support of the industry's activities. Through this approach there has been a reported progressive declining trend in sea lice in annually emigrating wild smolts.

Speaker 3: Dr Aude Jouaux (Conseil Régional de Basse Normandie)

“From Oyster Reference Centre to Aquaculture Regional Centre; Virtuous practices synergy with the environment as a model for aquaculture development”

Dr Jouaux clarified that the Oyster Reference Centre was set up after disease was found in 65-80% of oyster spat in all areas of oyster production in France, which decreased overall production dramatically and increased the cost of oyster production. Development of virus resistant spat via genetic selection has not yet been successful. However, the use of virus free spat and other rearing practices has been seen to decrease mortality in Pacific oyster. This has been mainly due to establishing the certification and traceability of virus free spat, the identification of virus free ‘Sanctuary areas’ for on-growing the virus free spat, and recognising the benefits of decreasing the density of oyster spat during on-growing. Research showed that the use of virus free spat reduces mortality of spat in sites with disease and at disease-free sites.

The Oyster Reference Centre is a virtual institute which acts as an interdisciplinary link between the aquaculture industry and research specialists, and works directly with shellfish farmers using sector support from public funds. Monthly meetings are held with scientists, professionals, and industry to enable consensus to be reached on issues of importance. Public funds have enabled the commissioning of expert academics in China and USA to understand the paths of infection and identification of genetic markers for gene selection.

The Aquaculture Regional Centre was established after it was identified that 80% of aquaculture products consumed in France were imported, highlighting a shortfall in French aquaculture production. The Aquaculture Regional Centre organised an aquaculture day to get political support and promote economic development (rather than focus on disease), it worked with aquaculture companies to identify their needs to enable expansion and provided a link between aquaculture and the relevant support companies.

Panel questions & answers (Dave Jackson, James Wilson & Aude Jouaux)

Q- Why do we have a treatment threshold for control of sea lice, as the evidence presented indicates that sea lice infestation on farms does not affect the wild fishery.

A. Treatment thresholds exist as sea lice are a ubiquitous pest which industry has to manage. Treatment triggers for sea lice are considered by veterinary surgeons as the most ethical control option as it is not ethical to use prophylactics as we don't want to put medicines into the

environment unless necessary. As the water temperature rises in spring and the development of sea lice populations begin, when 0.5 adult females per fish is reached in spring then this is a good point to interrupt with treatment, as it will prevent the exponential increase in sea lice. Correlation between wild population and specific farms cannot be proven without sophisticated modelling.

Q. What is the difference in response between voluntary and compulsory codes of conduct?

A. Inadvertent transfer of INNS involves the threat of punishment from regulators. Codes which are voluntary would not be expected to work unless everyone chooses to cooperate or have complete buy-in, therefore the code of conduct was incorporated straight into aquaculture business licences. It is also easier to make compulsory than negotiate complete buy in.

Q. Why are seed mussels not produced in Wales instead of relocating mussel seed?

A. Due to the biology of animals as broadcast spawners natural seed settlement is related to tidal conditions, and prevailing winds so is unlikely to settle where it is required and there is a high additional cost to placing seed collectors in the correct location. As mussels are a relatively low value product it is cheaper and easier to collect natural seed from elsewhere when available.

Q. Why not use European oyster instead of Pacific oyster to reduce mortality rates?

A. Pacific oysters are preferred in France but virtuous techniques can be applied in other mollusc species. Also past disease problems with native oysters reduce its appeal.

Q. Why is there no natural virus-free spat settlement in Basse Normandie?

A. There is a need to control entry of spat by certification from hatchery or natural virus free spat outside of the disease prone area because when the oysters spawn in summer the larvae are exposed to virus and the majority become diseased. If genetically selected resistant spat was to be used for production then this may not be fully resistant due to pathogen pressure in the environment. Another solution is required due to the intensive rearing causing any disease outbreaks to spread rapidly among oysters, so virtuous practices using virus-free spat associated with good aquaculture practices are a better approach.

Q. Are there only single year classes in a given Single Bay Management Area?

A. No there can be several year classes in a bay but they are in different pens and each age class is inspected separately with a standard and random cage chosen for each age class on each farm. Annual reports are available at www.marine.ie. Each farm has 1 inspection visit per month with 2

visits per site in spring. Inspectors sample 30 fish from one standard pen and one random pen for each year class.

Q. Does using different culture methods or systems affect mortality?

A. As long as virus free spat is used then there is no apparent difference between cultivation methods/systems.

Q. Do you think single bay approach works to manage sea lice in wild populations?

A. Yes. Evidence shows that controls of sea lice work well on farms. Data is not widely available for wild fisheries – there is no other data except from Norway.

Q. The SALSEA project suggested that sea lice in wild smolts is a problem.

A. This was a major EU funded project in survival at sea which did not look at sea lice but other aspects of mortality. The SALSEA project showed a decline in smolt survival which it suggested was due to migratory patterns and other potential sources of mortality in the sea including by-catch.

Q. Do you agree that the increase of sea lice in wild salmon, trout and arctic charr is due to aquaculture?

A. This is a controversial issue - Ireland produces 10-15,000 tonnes of salmon but Norway produces approximately 100 times more, however the sea lice problem in Norway is not 100 times worse, as would be expected if this were true. The level of mortality caused by sea lice is too small to see without detailed and complex statistical modelling.

Cefas clarified that sea lice will only be addressed in the project as one component of many environmental issues, and should not become the focus of this session.

Q. Is there scope to expand the code to include locally absent/new INNS species?

A. The code initially targets species of most concern. Code can consider other species if necessary by statutory conservation bodies. Values of codes created with industry can adapt and change targets more readily than formal bureaucratic rules. Codes can be flexible.

Q. How does code of good practice work to exclude known native but locally absent species which might be a problem ?

A. Example of Dee estuary having established Mitten crab population – the code was developed alongside an understanding of the life cycle of the crab, which enabled transfer of mussel seed from the Dee to occur at specific times. The juvenile crabs are known to move up to fresh water in June/July therefore the marine zone is free of crabs for a 2-3months period, which is the time used to access the mussel seed.

Q. Do you get any help for Regional Aquaculture Centre from EU authorities to increase aquaculture production in Basse Normandie?

A. Not yet - the short term increase in the value of the product for market is achieved via a marketing and commercial strategy, which encourages development of more aquaculture in Basse Normandie. The links created in the virtual institutes also reduce the set-up delay to enable faster answer or implementation of new aquaculture.

Q. Is the Oyster reference centre and aquaculture regional centre applicable in France as a whole?

A. The Aquaculture Centre is about making good collaborations and synergies so help can be given by region. The research program can be activated to address industry problems and create jobs. This requires a working group to be active in aquaculture at different levels.

Q. Why don't Basse Normandie cultivate natural oyster instead of non-native species? Why is there no natural recruitment/seed settlement?

A. Pacific oyster – has no spawning or few events possibly due to water temperature. No natural spat settlement for mussel too. Collection of spat is generally on the Atlantic coast, however scallop juveniles do settle in Basse Normandie. There is reduced production of flat oyster in France – due to prior mortality events after disease. Selective breeding of *Crassostrea gigas* was undertaken by collaborators in a project to try to produce a virus resistant strain, but this has not yet been successful. That would be one step in the process to restore natural oyster beds, although, realistically, environmental change may not allow restoration of native oyster beds.

Speaker 4: Mandy Pyke (Seafish)

Good water quality downstream and pollution alerts.

Ms. Pyke detailed that Seafish is funded by industry (by levy) in order to support development in a responsible manner, whilst protecting human health. Seafish recognises that it is important to understand the connection between land and coastal zone processes as upstream agriculture (cattle

access to streams) and human sewage (containing *E.coli* and norovirus) can affect the microbiological water quality in the immediate catchment, and also downstream water quality for shellfish harvesting zones. The harvesting areas are obliged under EU direction to classify shellfish 852/853/854 based on *E.coli* levels found in shellfish samples (Class A for direct sale, Class B needs purification (2 days), Class C requires heat treatment of the shellfish before sale).

It is difficult to get funds to rapidly improve sewage treatment works and expand tanks to improve water quality, due to improvements only being carried out ever 5/6 years according to the AMP phase budgets). In the meantime Seafish act as brokers between water companies and the shellfish industry and have piloted a text alert system for sharing near real time information on CSO spills from water companies monitoring. Water companies provide verification of a spill to Seafish which issue the alert to relevant harvesters on the voluntary text alert register in that area. This alert gives responsibility to the harvesters to enable them to calculate entry point of the sewage pollution 'plume' and to consider how tide, wind and dilution factors will affect their shellfish beds/production areas. Harvesters are then able to carry out active management to harvest, delay/cancel harvesting, or to enhance depuration. The water companies can then use the information from monitoring to review the operation of their assets and pinpoint where investments should be made.

A guidance document was produced to explain the CSO text alert initiative to the harvesters. This micro-catchment approach doesn't solve the problem of CSO discharges, however this shows that by working in agreement with the water companies can give harvesters the information required and the power to manage this problem from the harvesting end. This is a voluntary scheme so harvesters need to engage with the development process to develop the future of the CSO text alert system. This example of good practice shows that communication can reduce conflict and provide understanding to all parties to enable progress to be made to move past a problem.

Questions

Q. Is it mandatory that water companies publish their CSO spills data?

A. Scotland and N. Ireland water companies are owned by the state (also some by the relevant environment agencies). The Welsh water company is neutral and not owned by state. In England (and some international countries) water companies are large commercial companies which have to run as a profit making business but with expected high standards of corporate social responsibility.

Documents are published annually on spills. The key to addressing problems with CSO spills is cooperation with the water company to rectify problems, not punishment.

Q. Why should producers pay for sewage?

A. There is no published methodology for linking discharges from individual CSO or private overflow (septic tank) or other sources to enforce the polluter pays in most cases. Also enforcing the polluter pays principle as punishment is not as effective as working with polluters to address problems.

Comment-Under WFD water companies have to meet water quality standards and as the UK only has 1.5% of its harvesting waters classified as Class A then engagement with water companies is key to improve water quality in the UK.

Comment- It is well known that applications for planning development have been refused due to the development requiring sewage network improvements, and sensitive farming techniques have evidence that they work. Society needs to take a coordinated approach e.g. across all sectors including agriculture, land developments and aquaculture to achieve better water quality.

Speed presentations

3 minute – 1-2 slide power-points presentations on specific examples of good practices of improved environmental performance.

1. Grainne O'Brien (BIM) – *Aquaculture Environmental Management Systems*

Any farmer can adopt environmental standards e.g. ECOPACT (environmental code of practice) or other standards e.g. organic standards. Other widely recognised labels include Marine Stewardship Council and Aquaculture Stewardship Council labels. These labels use benchmarking systems to inform consumer choice and enable farmers to get a better price for their products. There are also retailer specific and business to business level standards which can encourage environmental sustainability.

2. Jo Halleraker (Norwegian Environment Agency) - *Relevant tools for management of wild salmon and impact of aquaculture in Norway*

52 rivers have been adopted as national salmon rivers/fjords, which covers 75% of the important populations in Norway and includes special measures to protect and enhance salmon populations. Environmental quality norms are set to ensure diversity, production and fishing potential of Atlantic

Salmon (alongside objectives of WFD). Spawning targets/conservation limits are set to dictate whether the fisheries are open or restricted.

3. Knut.Hjelt (FHL) - *Prevention of escapees*

Norway's goal is zero escapees from fish farms. Laws and regulations set the standards and measures which the industry is obliged to fulfil. Contingency planning includes prior agreements with fish farmers in the event of an escape. There is an official standard for technical aquaculture installations (NYTEK) and new installations are certified by inspection. Surveillance ensures that farmers report escapees/suspicious to the Directorate of Fisheries and Aquaculture escape commission (as part as DOF). All escapees and statistics are published in the public domain. Courses on escape prevention are available for farmers to attend. Close co-operation between authorities, equipment suppliers and industry ensures escapees are limited as far as possible.

4. Bob Seward (European Anglers Alliance EAA) –*Closed containment salmon farming*

Example of good practice is closed containment salmon farming e.g. at Langsand Laks, Denmark. Benefits are that it is bio-secure (no sea-lice present or chemicals required to treat disease), no escapees, less food waste, sustainable, and environmentally friendly option instead of open net cage farming.

5. Katherine MacManus (Marine Harvest Ireland) – *Monitoring to manage our marine resource.*

To obtain a marine aquaculture license requires benthic monitoring to be carried out. At every site – benthos is independently assessed along with other physiochemical parameters e.g. redox potential, C, N etc. The results from the monitoring influence farm management decisions e.g. the frequency and extent of fallowing, length of the site. A photographic survey is undertaken and compared against a reference area e.g. Loch Swilly – looking for positive redox potential as loss of oxygen is key indicator of the health of the site.

6. Alex Adrian (Crown Estate) – *Interactions management for mutual benefit*

The example of a management model based in Loch Fyne, Scotland, included a reduction in the number of sites in the loch, and reduction in number of sites near rivers but an overall increase in capacity. The key is to establish relationships, build trust for obtaining mutual gains, carry out a joint review and joint proposal with stakeholders. Joint management of adjacent stocks/farms to gain mutual benefits and maximum yield.

7. Gerry Gallagher (Irish Shellfish Association) - *Food Safety*

Ireland fills a demand for shellfish in Europe and is keen to be recognised as conscious of the consumer by carrying out shellfish flesh monitoring and monitoring for bio-toxins in water samples. Working closely with institutes enables a rapid 2-3 day turn around on samples. The HABS website is a publicly available resource. County councils all take different approaches to management of marine areas– so there can often be issues with licensing and site availability. Codes of practice are available.

8. Presented by Keith Jeffery (for CCW and Cynrig) - *Crayfish and freshwater pearl mussels*

In the River Irfon catchment a combination of man made impacts has meant that both freshwater pearl mussel and white clawed crayfish populations have previously virtually vanished. Both white claw crayfish and freshwater pearl mussels are protected and endangered. Populations have been supported by aquaculture research using recirculation, chillers, and UV sterilisation techniques, taking adults from donor populations to successfully breed juveniles to reintroduce back into restored and improved rivers. There have been some noted population improvements so far due to this project. For IUCN red list endangered species aquaculture may sometimes be a solution to mitigate environmental impacts.

Panel questions & answers

Q. How long does it take to gain mutual results from interactions management?

A. The example began in mistrust/wariness, now the company is involved in following all its sites synchronously which has a big commercial impact. If people do what they promise, they quickly gain trust and respect. Trust means stakeholders are more likely to listen. The process is not quick, this example took several years and various events.

Q. Does interactions management remove all conflict and make everyone happy?

A. It doesn't mean nothing bad happens, but each party now trusts the other to sort issues as they arise, to maintain and monitor, it removes the knee jerk conflict reaction. Promises are delivered.

Comment: Cooperation between industries, Research and Development, and veterinary surgeons is important.

Q. Does aspect of scale change in different countries?

A.Trust building at small local scale is important

Comment: It is recognised that in Ireland there is a problem with inland fisheries and poor communication with other agencies.

Q. Is there an economic principal for zero escapees in Norway?

A. There is economic value to every fish in the pen and losses are expensive. When aquaculture gets good prices for fish it consequently allows better investment in fish pens to keep them in. Economics help drive improvements.

Comment: There is often huge environmental value to areas where aquaculture is planned to occur. During the expansion of aquaculture across the EU28 it would be a mistake to not carry out sufficient planning and management which would identify important seagrass beds etc. There must be more effort to include/consult with environmental NGO's when constructing documents such as ECOPACT.

Break out Groups

Discussion of what constitutes good practice for ensuring better environmental performance across all types of aquaculture in the context of the WFD and MSFD

Break-out group results – and grouped summarised data from session 1



Dublin - Break out 1-
Raw Good environme

Session 2 Sustainable development of aquaculture / international perspectives

Speaker 5: *Yngve Torgersen and Tor Simon Pedersen* (Norwegian Environmental & Fisheries Authorities)

Norwegian aquaculture: Balancing increased food production and environmental sustainability

Tor Simon Pedersen explained that Norway is not a MS but an EEA state. This has certain obligations e.g. compliance with WFD as part of that agreement. WFD is seen in Norway as an

important tool to maintain and improve the water environment, benefit food production and safeguard fisheries and aquaculture for the future.

In Norway, the aquaculture industry is large and has tripled production over last 15 years (mainly farmed salmon for export), currently supporting c.20,000 jobs. Expansion was possible as new methodologies have been developed and implemented including quality standards for wild salmon stock and limit values for sea lice and escapees. Legislation: the WFD was transposed into Norwegian water regulation in 2007 so is not following the same time scale as the EU. Norway is 6 years behind planning cycles which enables the country to learn from other mistakes/good practice elsewhere. Atlantic Salmon have experienced a decline in both wild catch and reoccurring/returning to spawn salmon due to a number of pressures (including sea lice/parasites, escapees of farmed salmon, ocean acidification). Fish farms are recognised as a contributor of nutrients to the marine environment (especially nitrogen).

Yngve Torgersen described a good practice example of licensing procedure –Norway introduced a one-stop-shop for applications. One application is made to the county, who copy the application and send it to different sector authorities. Local municipality announces the application to public, a time limit applies (6 months) to responses from administrators and the final decision is distributed through the county. Expansion of Norway's aquaculture industry has been possible through discussion, transparency, and solution driven cooperation, between authorities and aquaculture industry, science and nature as well as political ambition to increase production of food, safeguard fisheries and aquaculture industry, improve knowledge and techniques in farming and monitoring.

Key instruments to enable environmental sustainability of the expanding aquaculture included: designation of national salmon fjords/rivers (as protection against aquaculture and other), Research and Development (e.g. vaccines to reduce use of antibiotics), introduction of compulsory technical requirements to prevent escapees (developed by industry and science and used in legislation-NYTEK 9415, standard for floating fish farm construction, mooring and net strength, detailing how to repair, put together and maintain), benthic monitoring and surveillance of on-growing fish farms, MOMB analysis to decide fallowing period, ongoing development of sustainability indicators, Atlantic salmon quality norm and development of a simple indirect monitoring system for possible environmental impact based on numerical scoring (Zero = no impact, higher number = higher risk or likelihood of impact).Used as a cheap proxy to assess risk where sites identified as moderate and high risk will require further verification to examine potential impacts.)

Questions

Comment: When you give appropriate consideration to issues such as sea lice and escapees you can deal with them better.

Q. Do you think there is potential for expansion of the aquaculture industry in Norway or in other countries?

A. Although Norway realised there were problems with sea lice before the WFD, ongoing management of aquaculture will fall under the WFD. The Norwegian govt does not comment on the expansion of aquaculture in EU countries.

Q. What is the allocation of pre-licences and bidding procedure in Norway?

A. A licence is needed to operate in Norway. The limit is a maximum of 780 tonnes of fish on the farm. Licence has to be purchased.

Q. Is expanding aquaculture in Norway a political pressure or an independent process?

A. The fish farmer pays for site application with a risk that may not be passed/approved. Used to be 1500 fish farms sites, reduced down to 700 sites now, so there is room for others sites. To extend the size of the site producers have to go through the licensing procedure again. There is a strong financial incentive for the applicant to get it right. Money from licensing goes to local municipality.

Comment: Spain has a one stop shop but it depends how you use this tool, it could be worse depending on political and social will. Administrative procedures need to be swift.

Q. Can you expand on what sustainability indicators are in Norway?

A- Escapees, genetic interaction between wild and farm, sea lice, benthic monitoring.

Comment from Cefas: As contractor, we have specifically been tasked with engaging with the JRC, the European Topic Centre and the European Environment Agency on sustainability indicators for aquaculture. We expect to refer to this work within the background document.

Q. There is similarly a one stop shop in Ireland, but it has a longer consultation process than Norway. Do the aquaculture free zones exclude shellfish farms or just fish farms?

A. Rationale behind aquaculture free zones is the national salmon fjord/rivers which are specifically protected for salmon etc., and in principle, shellfish may be allowed in these areas but not fish farms. The same issue applies in marine protected areas which may have unique habitats e.g. cold water coral reefs or cod spawning grounds, therefore the purpose of implementing the protection needs to be considered when debating whether and where to site new aquaculture in MPA's.

Speaker 6: Anne Dom (Seas at Risk)

NGO priorities for environmentally sustainable aquaculture in the EU

Ms. Dom explained that Seas at Risk is a European NGO based in Brussels (representing 20 national NGO's from 14 diff countries). The EU policy push of the blue growth agenda for economic growth and employment has identified aquaculture growth as a key sector. In addition, the Common Fisheries Policy acts as a driver for the aquaculture sector and the new European Maritime Fisheries Fund (EMFF) includes funding for aquaculture. There will be more government funding for aquaculture than wild fisheries in the future.

NGOs are not against aquaculture growth in a sustainable manner but are interested in creating environmentally aware demand from seafood consumers. Aquaculture and nature are not mutually exclusive, but the limits to growth need considering by analysing each sector according to which should be able to grow, also predicting how demand for future products is broken down (why, what ,how, when and where). Encourage industry to take a precautionary approach and to use the ecosystem approach to develop aquaculture (regarding carrying capacity etc.) including management of economic and social considerations.

The HOPE conference expressed that global seas are overexploited from an ecosystem point of view so there is possibility that aquaculture can bridge the gap between reduced wild capture fisheries and increasing demand for fish. It is important to consider if increasing aquaculture product consumption is realistic/allowable/sustainable, and also/instead explore issues such as wasted food, other feed sources (e.g. insects) as alternatives to bridge food gaps.

NGO concerns regarding sustainable aquaculture expansion include feed efficiency, feed sourcing and sustainability, chemicals, disease, wider ecosystem impacts, ranching of endangered species for consumption instead of conservation e.g. blue-fin tuna and eel, data/knowledge gaps need addressing. The definition of sustainable development needs reinforcing as it is not globally

accepted/defined, and the labelling of 'sustainable' products is varied and not overarching, which is confusing to consumers.

There is need to translate sustainable aquaculture principles into measurable targets and indicators. Find agreement on product and labelling standards, address knowledge gaps and generate data/evidence, implement maritime spatial planning, integrated coastal management, make multi-annual plans. Apply the polluter pays principle, integrate management processes within legislation, make SEA and EIA assessments, produce good practice guidance for producing SEA and EIA. Include public consultation and participation involve all stakeholders in planning aquaculture. Create technical standards for aquaculture facilities, minimise negative impacts on biodiversity, reduce medicine and chemical use (and produce data as evidence). Promote and fund multi-trophic aquaculture and aquaponics. Use public funding for good practices and common goods e.g. data. Promote environmentally sustainable global trade to reflect EU standards. Promote environmentally friendly aquaculture (consumer awareness, labelling). Promote best practices across EU.

Panel questions & answers

Comment: Be aware that producers do not deliberately destroy the environment and desire imports. It is difficult to make a living from aquaculture and we need to look at the nutritional potential of salmon and shellfish as protein rather than intensifying or expanding agriculture on limited amounts of land.

Comment: It is apparent that aquaculture and NGOs all want the same thing: better water quality. We are all in agreement for sustainable aquaculture.

Comment: We seem to all want to work towards achieving the same results in each sector.

Comment: Shellfish are a good animal based food protein and no food should be wasted. It must be considered that all human activity has some environmental impact therefore perspective is required, as some NGOs act as unnecessary barriers to the growth to aquaculture.

Comment: Aquaculture is run as a business; therefore it is necessary to invest in security of environment for the security of the business. The European Commission, governments and NGOs

should acknowledge good practice and any business exceeding legislative requirements should be recognised by a scheme. To ensure businesses buy in to these schemes they need incentivising.

Comment: There is potential for a reduction of charges in Scotland to recognise good practice performance and increased charges for bad practice. Scotland also publicise good and bad performance on fish farms, for producers to use as publicity for selling their product to higher markets.

Comment: Certification schemes are used to recognise producers voluntarily performing above the level of requirements.

Comment: In Spain aquaculture farms have to pay for using water/space, but can reduce tax if produce is certificated environmentally friendly e.g. IMAS – 50% reduction, ISO 14000 25% reduction, bad environmental performance means producers lose their licence. So incentives can be financial or otherwise.

Comment: If higher environmental standards are implemented by producers then benefits could be to allow producer to increase their maximum allowable biomass to recoup losses. Production standards are expected e.g. organic, which increase costs, but producers are penalised and disadvantaged if they don't have it. The licensing process should be made easier for environmentally friendly methods and the direct link made between higher environmental performance and the amount they are inspected. Certification doesn't always improve product prices as the buyer expects high environmental standards and food safety as a given but will not want to pay more, so more standards may not improve the system.

Comment: Under MSFD and WFD aquaculture is accepted as being one of contributors or pressures to not achieving GES. Stakeholders must work together toward improving environmental standards to achieve GES.

Comment: The issues with applying the precautionary principal route to aquaculture is the way that it is regulated differently than agriculture. Look at a way of regulating which incorporates review and acknowledgement to incentivise industry instead of regulating to exclude.

Comment: This background document is not to be an industry handbook but also provide good practice examples in regulation and implementation, in context.

Comment: The aquaculture sector has a role in developing instruments across Member States to manage ecosystem pressures. There is an opportunity to create sustainable yields from the sector whilst managing WFD and MSFD impacts.

Comment: To expand aquaculture, enable and allow small player businesses not just multinationals.

Cefas thanked attendees for their attendance and contributions. Day 2 is to address Implementation and administration of WFD and MSFD for aquaculture.

Day 2- Friday 11th April

Session 3 Good practice examples: effective and cost-efficient transposition and implementation of the WFD and MSFD for aquaculture Chair *Neil Auchterlonie*
(Cefas)

Speaker 7: Donal Maguire (BIM)

The CLAMS process - 'integrating aquaculture into local communities or creating social licence for aquaculture at a local level'

Mr Maguire clarified that aquaculture is not a private industry in Ireland as aquaculture operators are licensed in commonage (i.e. held in common). National level policy setting happens as both a top down and bottom up system, which eases the implementation of policy and enables feedback to be returned back up the system about how new rules are working.

The volume of aquaculture produced in Ireland has declined since 2005 but the value is relatively stable, with finfish value dominated by salmon and shellfish value dominated by farmed oyster. New species aquaculture farms (e.g. perch, char, abalone, aquaculture seaweeds) are now developing. Aquaculture can attract negative attention in Ireland as it is licensed, and in the public perception and media view it is seen as environmentally damaging. The Coordinated Local Aquaculture Management Systems (CLAMS) process was created to integrate aquaculture and its structures into the local communities. Aquaculture producers get involved in CLAMS as a strong social driver to support employment and raise understanding.

Clams and Single Bay Management (salmon farming) involve BIM and state agencies working with industry at a local level to make aquaculture accessible at a bay level to provide common understanding and improve communication. The aquaculture industry is placed in the vision of policy makers, individual plans are published/produced and lodged in local authority libraries to explain aquaculture to public and local authorities and an explanatory handbook was developed. Implementation of environmental and water quality monitoring for WFD occurs through liaising with the CLAMS process groups. CLAMS groups also promote voluntary environmental management systems to back up aquaculture production e.g. signing up to ECOPACT or other aquaculture specific ecological label and organic certification ensures better prices for produce.

One CLAMS successful example is at Killary Harbour where the process aimed to improve the perception of aquaculture, including its visual impact e.g. by using neutral colours for non-navigational buoys and rafts, reduced aquaculture levels, removal of redundant structures including abandoned oyster trestles removed for recycling, and old rafts removed from the harbour. The restoration of the environment enables aquaculture to now be a boat tour attraction for tourists. The CLAMS process addressed aquaculture issues through discussion and mutual agreement with the producers to realign and reduce the number of mussel lines in the lough. This agreement used better spatial planning to improve productivity (better access to food) and also compliance, Health and Safety, and workers access to land mussels leading to potentially better shelf life of the product and higher value.

Special Unified Marking Schemes (SUMS) funded by BIM and carried out with local farmers through the CLAMS process, to enhance safety for all stakeholders by creating clear lines around production area, reducing the number of individual marks and involving locals in installation of new markers. The marking system included poles and signs to inform public and integrate aquaculture operations into the local community, improve Health and Safety, as well as compliance and use of other stakeholders. The CLAMS process helps improve public perception of aquaculture as through the process industry are involved in beach cleans and engage with local schools (prizes, sponsored football cup and set up a children's art competition associated with the CLAMS group).

Questions

Comment- There are many examples of success in implementing a feedback process to policy making, including designation of Shellfish growing waters where the Shellfish Waters Directive

needed implementing (top down pressure), however allowing bottom up response from growers enabled fit for purpose proper implementation of directive in England.

Q. Where do drivers for the CLAMS process come from – participants/farmers? Or is it BIM facilitating?

A. Depends on the individual groups. There is a regionally placed aquaculture development officer who organises frequent meetings, including hiring rooms, taking minutes, and keeping things moving forward.

Q. For CLAMS group and local action groups across the EU, is there funding available from EFF?

A. CLAMS predated EFF, developed under FIFG in 1998 so has been developed, tried and is now trusted. It is low cost, with a local instead of national focus.

Speaker 8: Douglas Sinclair (SEPA)

Aquaculture Regulation and Scotland's Aquaculture Database

Mr. Sinclair described how Scotland's environmental regulator (SEPA) issue permits regulating discharges by the industry, and complying with WFD. The main aims of Scotland's regulatory controls are the overarching protection of 'far field' water body as well as to protect the environment near field in vicinity of fish farms. The approach includes 2 zones – Zone A (near field)– where near field controls and standards are applicable, and Zone B (far field) takes a carrying capacity approach to far field protection, considering the cumulative effect of fish farms in water and categorising water bodies 1 to 3 to indicate their prospect for further aquaculture development. This approach protects the carrying capacity of a water body by not allowing more farms to be implemented if a water body is at risk e.g. when the scale of fish farms is approaching 5% of the water body then no further farms will be allowed.

The near field approach includes monitoring of the benthos immediately underneath fish farm assesses the benthos ability to process organic waste. Computer models are run to calculate the farms footprint from gathered data to calculate impact of fish farm so biomass limits are set, medicines are limited, mixing zones are set where it is accepted that limits will be exceeded near the farm but at boundary conditions must be met. Monitoring samples are taken under cage and at the edge of boundary and compared to a reference sample. Monitoring, inspections and records audit are carried out, farm compliance reported and published publicly.

In 2013 a publicly accessible database on Scottish aquaculture went live to display individual farms licensing and monitoring data to the public, industry, planners and government. The website includes a searchable map to click on individual sites to display information on movement restrictions, licence conditions, monitoring results, bio-toxin and phytoplankton results, escapes, emissions, microbiology, sea lice treatment results, biomass etc. The database is comparatively cheap, with free easy access to information.

After the repeal of the SWD, WFD became the primary legislation and expects the protection of the former legislation to be upheld. Scotland has aligned standards and boundaries with hygiene regulations. Simplified microbiology testing of faecal bacteria aligned with hygiene regulations and dropped chemical determinants e.g. salinity and colour. Other pesticides and metals will be picked up in WFD monitoring for ecological status. Discretion can be used to undertake a cost-benefit analysis and can potentially set differential targets across a shellfish water Protected Area. Protection is integrated into RBMP's to enable prioritisation for competing interests.

Questions

Q. Locational Guidelines are not precisely parallel to WFD requirements- what happens when water bodies don't meet the objectives of GES-WFD due to aquaculture?

A. In marine water bodies, aquaculture is not the sole reason for failure e.g. also dredging etc. It is however accepted that fish farms are contributors to failing GES-MSFD.

Q. New activities under WFD article 4.7.will require new licenses, is there a process in place in accordance with this?

A. Yes, Scotland's process includes consideration of that.

Q. How does Scotland's process handle fish farm effects in waters away from the water bodies where the farms are?

A. Scotland seeks to deal with this through spatial planning and a landscape approach and consents for presence of fish farm will take escapees into account. Environmental permits are not a good way of regulating some effects as they may set a limit on emissions but a fish farmer may not be able to control release of sea lice from cages, therefore this is not used in an environmental permit.

Q. Is there an assessment completed for licence applicants with existing mature rigs who want to add more/expand?

A. Pre-consultation is encouraged in Special Areas of Conservation (SAC's) and guidance given. Where the SAC is created to protect sea grass beds and isolated reef features assessment may consider the footprint of a larger farm and where waste will impact to enable licensing. For new sites, the process is predictable – if the fish farm company collects data and runs a model – then they will succeed in their application if the model is followed and applied. If the impact of the size of the fish farm and the footprint are defined in advance this defines the boundary where standards need to be met. If the monitoring standards are not met then the biomass of fish will have to be reduced or speak to farmer to address problems. A new 500 rope mussel farm was set up in a Natura 2000 site as restrictions only require authorisation for fin fish farms, they protect water quality for shellfish farms but don't licence shellfish farms.

Speaker 9: Phil Thomas (FEAP, SSPO)

'Creating Frameworks of Good Practice'

Prof. Thomas explained that good practice terminology needs to be correctly defined. Good practice is fully effective performance of documented operating procedures. Good practice includes clear evidence-based definition of objectives and achievable outcomes; well designed proportionate, properly transposed and enforced legislation, fully adopted industry codes of good practice and approaches; professional management and a trained skilled workforce; and evidence-based decisions. Good practice requires regulators to avoid one size fits all legislation and avoid transposition that is difficult to adopt (understanding is needed). Research and Development is essential to provide an evidence base relevant to aquaculture in practice, in order to develop workable solutions to challenges for the aquaculture industry. Codes of good practice need updating regularly to reflect technology and new legislation. Effective stakeholder communication is critical for enabling compliance with operating procedures.

Legislative and regulatory burdens make it difficult to get new aquaculture sites approved, and are time-consuming and costly. This burden can be disproportionate when compared to farming, forestry and other types of industry. Good practice should be shared and made transferable between countries. However MS also need to address poor practice to allow them to achieve good practice.

Examples of good practice include: (a) computer-based modelling toolboxes for the planning and operation of shellfish and finfish aquaculture; (b) codes of good practice which are supported by industry and government, independently audited and provided in electronic format accessible by all stake-holders); and (c) publication of information (e.g. on websites) from statutory and industry bodies (e.g. in Scotland, SEPA, Marine Scotland, FSA, Crown Estate and SSPO).

Progress is required to improve: (a) models to address large farms and areas of energetic water currents etc; (b) the aquaculture development planning process, which involves a large number of agencies (in Scotland) and elected local government representatives who are non-specialist but may have to deal with complex technical information; (c) the licensing of discharges - discharging the same material in same place may require two different licences from two different regulatory bodies (e.g. discharge of medicine from well boat or net fish pen); (d) understanding of species management and wild population data (e.g. brown trout and the factors influencing their migration).

In Scotland, the west coast and islands areas where salmon are farmed contain only a small proportion of the national wild salmon resources. Planning restrictions preclude the development of finfish farms on the north and east coasts where there are the main national wild salmon stocks. These restrictions were originally intended for salmon farming but have been applied to all farmed species. Comparison of Scottish Government monitoring data between the areas with salmon farming and those with no salmon farming, indicates farming has no impact on wild salmon catches at the regional population level.

FEAP-wide perceptions are that multiple agencies and multiple national legislations cause problems with aquaculture across the EU, from bureaucratic systems, inconsistencies in the approach (e.g. causing differing costs to aquaculture within the country), lack of parity with other resource users and poor levels of aquaculture understanding. FEAP promotes that good practice is taking a catchment-based risk-based management approach.

Questions

Cefas- commented that therapeutics discharged from a vessel such as a well boat is considered dumping at sea, however discharging therapeutics from a net pen is considered under different laws (FEPA).

Comment- Problems for aquaculture such as this would be made easier by being able to apply to one place for one licence. This problem with discharges should be fixed to reduce the complexity of legislation affecting aquaculture.

Comment – there should be a mechanism for agencies to choose to pass responsibility to other agencies to ease applicant’s difficulty.

Comment -The apparent paradox between the level of requirements from DG MARE for food production and agriculture on land, and food production from aquaculture in the marine and freshwater environments, identifies the need to reduce bureaucracy. There is also apparent difference and conflict in the requirements to increase food production from DG MARE and to protect delicate marine resource for multiple public stakeholders from DG ENV. Legislation from Europe and national administrators to ensure environmental protection is constantly increasing. Member States want to reduce bureaucracy, yet receive pressure from complicated regulatory requirements implemented to protect tax payers from fines for breach of environmental legislation.

Q. Are DG MARE and DG ENV talking about the apparent paradoxical approaches as they need to take a joined up approach on behalf of MS.

A. Cefas – We are the contractor for this work, and therefore represent the project team undertaking this work on behalf of DG ENV and DG MARE and as the contractor we cannot speak directly for DG ENV and DG MARE, but we are able to confirm that they are working very closely together on this project. It is also worth adding that streamlining and improving the efficiency of the licensing process is one of the objectives related to aquaculture within CFP reform.

A. DG MARE – There is cooperation between DG ENV and DG MARE however this is a difficult paradox to address as there is always conflicting pressure from both environmentalists and industry.

Speaker 10: Javier Ojeda (APROMAR)

Galicia fish farm planning

Mr. Ojeda presented on fish farm planning in Galicia, an autonomous region of Spain with its own government. Galicia is the most important aquaculture area in Spain, producing >8000 tonnes of turbot, also some sole, trout and mussels from 16 farms, and 5 hatcheries which employ 600 workers in total and are worth 16 million Euros. The fish farms are land based and highly technologically advanced. There are economic and social drivers to increase aquaculture production but it does not happen. The last new farm opened in 2004, and the last farm enlargement was 2007.

It is mainly seen as a governance problem as land use at the coast is challenging in higher population countries, there is a plethora of rules inadequate for aquaculture and an unlevel playing field on production and marketing regarding imports. However citizens are accepting of new fish farms being developed as they provide alternatives to unemployment and seasonal tourism based jobs. Successive governments have tried to increase aquaculture without success as Spanish law restricts construction close to the coast. A legal exception needs to be made for land based farms.

In 2008 an initiative was set up to select land suitable to create marine land based fish farming at regional level by overcoming lower level regulations. Objectives were that there should be only 1 new farm per area, using best environmental practice to exclude sand dunes and priority habitats for Natura 2000 etc, away from urban zones, beaches, touristic or culturally significant areas, with a minimum of 60,000m² required. Sites were to be >3.5km from potential contamination points and the ocean water supply required low microbial conditions, correct salinity and water temp. These objectives left no areas suitable for potential development therefore highlighting that having a plan is not enough.

Problems restricting aquaculture development in Spain and the EU are: overuse of the precautionary principle, high taxes for use of water even if it is returned to river and not consumed, non acceptance of internationally recognised carrying capacity models, unreasonable taxing on effluents, restrictive criteria for determining environmental flows (amount of water that needs leaving in river) used to be 10% now 20% using historical data (seasonal river variation), insufficient industry knowledge by environmental competent authorities, debt crisis made environmental taxing more socially acceptable, sensitivity to criticism by minority groups in media etc., other stakeholders conflict and competition- others more successful in lobbying

Good practice examples include 1)Stolt sea farm producing turbot opened in 1993 and produces 1200 tonnes of fish per year with a marine protected area being set in the waters around the fish farm, 2) Trout farm produces 3000 tonnes of fish per year since 1969 with environmental conditions remaining almost perfect.

The WFD and MSFD are legal frameworks which aquaculture should comply with and benefit from, rather than fall victim to. Competent Authorities should implement EU environmental legislation without imposing unnecessary burdens or unfair competition on producers (as expected by the European Commission).

Regional and national authorities can change the way they implement these directives and reduce the huge differences in implementation across the EU by carrying out EU level analysis and harmonisation of: 1) Precautionary principle- establish common understanding for aquaculture types, 2) how to tax use (not consumption) of water (share good examples), 3) carrying capacity models (share and explain models), 4) taxing of effluents/contaminants (pay in proportion), 5) determination of environmental flows as flow is not only way to control water (also examine sewage load etc.). Good governance for aquaculture has been demonstrated in Scotland and Norway. To enable the changing of governance requires greater understanding from administrators and improved communication within country ministries.

Questions

Q- Is it possible to redesign existing farms using new water flow technology e.g. recirculation?

A. It is possible but not competitive. Recirculation is a good concept which works quite well up to certain biomass but for higher than 1000 tonnes it becomes very complicated.

Comment: Partial recirculation would be cheaper and require less effort.

A. Farmers would have adopted this technology if it was possible financially etc. They also have seen this technology fail, as in practice cooling river water for use is not successful in the Mediterranean.

Q. Who is the document for? Regulator or industry? Need to avoid inconsistent approach by regulators in final document.

A. Cefas: The objective of the project is to produce a document relating to environmental legislation for the sustainable development of aquaculture across EU-28. Workshop is to share information which is likely to form annexes to the document. Meeting notes will be one annex to the workshop. Information shared will be drawn into document. The primary audience for the document is MS national administrators, but it is envisaged that it will also be useful to both the industry and NGOs. The aim of the document is to clarify and standardise the approach to sustainable aquaculture development across the EU-28, from an environmental regulatory perspective.

Q. Will there be the opportunity for comment on the document at the draft stage?

A. Cefas: After the 4 regional workshops, the draft document will be produced and discussed at the second Brussels workshop. The draft will be shared with representatives that were invited to and attended the first Brussels workshop, to enable them to review it before attendance. That second Brussels workshop will include discussion and take feedback on suggested improvements to support the production of the final agreed version.

Q. Will people who missed the first Brussels meeting be re-invited to the 2nd Brussels meeting?

A. Cefas: Invitations will be released by the Commission rather than Cefas, but, yes, it is likely that those same people invited to the 1st Brussels workshop will be re-invited to the 2nd.

A. DG MARE– does not know the answer to this question but will find out.

Comment - The document on environmental legislation should clearly include the objective of how to improve and lighten the economic burdens.

A. Cefas: This is outside of scope of project, which is specifically looking at MSFD and WFD, providing clarity and background information on implementation. Economic guidance is therefore outside of the remit of the document but may follow afterwards if the Commission requires it, but as contractor we have not been asked to look at this aspect.

Comment- The document will have to offer Competent Authorities at national level details on how to lighten burdens for industry.

A. Cefas are instructed by the Commission that the document should complement the existing Natura 2000 guidance document and the document produced will follow a similar format.

Speed presentations

Member State approaches to transposition and implementation of WFD and MSFD by representatives of the National Administrations

1) Richard Cronin (DECLG) - Ireland

Marine waters within the Exclusive Economic Zone (EEZ) are to include implementation of the WFD out to 1nm. WFD is transposed in Ireland by the enabling act of 1972 to create statutory instruments to transpose European legislation. The EU Common Implementation Strategy has issued guidance on implementing the WFD across the EU MS.

RBMPs have been produced for 7 river basin districts, to comply with the WFD. In contrast, it is still early days with implementing the MSFD as it is just past the first milestone so pragmatism is required. Ireland is adopting the precautionary principle and taking actions appropriate to the level of knowledge we have.

Gap analysis research is required. Research must be scaleable and transferable across river basins and ecosystems and at an appropriate scale to make decisions

Challenges for implementing the MSFD are 1) all new governance structures and institutional arrangements across 11 descriptors, and as aquaculture crosses all descriptors – temporal and scale issues are a challenge, 2) that it is difficult to carry out effective engagement with public and stakeholders who lack a full picture of understanding 3) the high levels of ambition in MS, EU, NGO's, 4) that current forums exist for fostering cooperation but synergy is yet to appear (e.g. OSPAR, HELCOM, ICES) and challenges in empowering those forums to work 5) the moving of goalposts during mid cycle which causes friction at MS level, 6) finances – it would be useful for the Commission at DG ENV level to repurpose regional European Maritime and Fisheries Fund EMFF for use in MSFD.

Current work: 1) Monitoring (including Celtic Seas, North Sea joint monitoring program) should use up to date technology and existing platforms including remote sensing, and use common indicators to measure performance of territorial waters and how they work on an ecosystem level, which would remove the issue of failure to inter-calibrate. A cost effective approach is different than cost benefit approach. 2) Addressing Programme of Measures (including how to define them and how to implement them) and stakeholder engagement e.g. MARLISCO as a template for non confrontational stakeholder engagement. 3) As the WFD is beginning its 2nd cycle there are new structures in Irish government and new Irish legislation coming into force – working on taking a holistic approach to MSFD and WFD. 4) Addressing the economic assessment requirements of WFD which could take 3 approaches: cost effect, cost benefit, and SEA/EIA as under article 13.3 there must be an impact assessment. Work is being pursued to manage environmental impacts of aquaculture development.

2) Elaine Connolly (DEFRA) - England

England has a relatively small aquaculture industry, with the majority of finfish and shellfish being wild caught rather than produced by aquaculture. England implemented regulation for WFD via the Water Environment Regulations 2003, and the Environment Agency, as the Competent Authority, is carrying out a series of large public consultations 'Challenges and choices' as planning for next RBMPs. The focus of WFD work is achieving Good Ecological Status and includes realigning rivers and removing barriers to fish movement. WFD is in its 2nd cycle including RBMP's and England is currently planning now for that process including carrying out cost analysis at local level.

The MSFD was implemented via the Marine Strategy Regulations in 2010 with a series of consultations planned. A consultation on a Programme of measures (POMs) is scheduled for 2015. England are taking a similar approach to Ireland by building on lessons learnt from cycle 1 of the WFD. Keeping costs lower by building on existing food hygiene monitoring programme and using existing structures e.g. OSPAR convention.

The challenges include the complex legislative regime for terrestrial planning and marine licensing which pre-dates WFD and MSFD, access to finance, balancing cost effective environmental interventions against other priorities, and implementing MSFD in the light of lessons learnt from WFD.

Break out Groups

Discussion of what constitutes good practice for effective and cost-efficient transposition and implementation of the WFD and MSFD.

Break-out groups results– and grouped summarised comments from session 2



Dublin - Break out 2
- Raw - Good practice

Summary and next steps (*Neil Auchterlonie*)

This was the first of 4 regional workshops, with the next three in Athens, Vienna and Copenhagen, concluding with a 2nd Brussels workshop. Summaries of the regional workshops will be made available for comment a few weeks after the workshops, once they have been reviewed by the Commission, and final meeting notes will be made available on the project website in due course. The afternoon session is focused specifically on engaging with national administrators. Dr. Auchterlonie thanked DECLG, Dublin Castle, and all for attending and contributing to the workshop.

Close of workshop- Donal Cronin (DECLG)

Annex 3: Minutes of the Mediterranean Regional Workshop (Athens)

Background Information for Sustainable Aquaculture Development, addressing in particular good practice in environmental protection, and implementation and transposition of the WFD and MSFD

Regional Workshop 2: Mediterranean

Venue: Amphitheatrum, Ministry of Environment, Energy and Climate Change, 36 Trikalon & Mesogeion Street, 115 26, Athens

Date: 5th and 6th May 2014

5th May 2014

Introduction to workshop: Neil Auchterlonie (Cefas)

Dr. Auchterlonie welcomed attendees to the workshop. A summary of the aims of project, the purpose and context of the workshop and details of how attendees can contribute was provided, emphasising a real need for attendees' contributions in the regional workshops to achieve a successful project.

Speaker 1: Prof. Ioannis Karakassis (University of Crete) Keynote Presentation.

Environmental Interactions in Aquaculture: Implications for Site Selection and Carrying Capacity in the Mediterranean

In order to maximise aquaculture output without damaging sensitive coastal ecosystems and reducing the potential for future production it is important to establish carrying capacity for aquaculture sites. Ioannis Karakassis described how allocated zones for aquaculture (AZAs) are being introduced in Greece as a tool for the sustainable management and development of aquaculture. AZAs allow the prioritisation of aquaculture whilst allaying local concerns regarding industry development.

Successful adoption requires the establishment of acceptable levels of environmental change and requires research to support the setting of these standards, and regular monitoring to ensure these are not exceeded. This is achieved through the use of environmental quality systems (EQSs). Consequences such as mitigation measures or restrictions must also be agreed for instances where these are exceeded.

Prof. Karakassis outlined the parameters that were selected for the calculation of carrying capacity and the monitoring of fish farms, and explained the different types of carrying capacity that have been identified.

Examples were provided where long term production within carrying capacities led to beneficial impacts on local fish stocks.

Questions

Q: What about fish farms over *Posidonia oceanica* beds?

A: Farms located over *P.oceanica* are required to be moved. New farms may not be located over these grass areas.

Q: Does the calculation of carrying capacity take into account external inputs such as effluents from agriculture?

A: AZAs should be located in areas where there are few external inputs and should avoid areas with large fluctuations in water quality. Continual monitoring is necessary to re-assess carrying capacities.

Q: Fish farm implementation may lead to initial local increases in fish stocks and then a decrease.

Over what time period was data collected for the example of beneficial effects on local fish stocks?

A: Approximately 15-20 years.

Q: How far was this farm from the coast?

A: It was a group of farms, located close to the coast. Effects were widespread and were as a result of increased primary production and not just local increases from consumption of faeces and unused feed

Q: What is process of licence application for the establishment of Greek aquaculture operations?

A: An environmental study or soft modelling is required to identify any major issues. These do not always predict effects effectively due to the complexity of the ecosystems.

Speaker 2 Associate Prof. Elena Mente (University of Thessaly)

Sustainable aquaculture development: the case of organic aquaculture

Elena Mente discussed organic aquaculture and explained how it combines best environmental practice and improves animal welfare and sustainability in order to enhance the production of high quality protein for human consumption.

Associate Prof. Mente outlined the history and rise of organic production and explained what is permitted to use in organic production as fish feed, or in the treatment of disease. It was emphasised that the amino acid content of organic feed has greater similarity to the muscle tissue of the organic fish and additionally organic practices result in considerably lower levels of microbial communities when compared to conventional farms. This suggests that conventional versus organic fish aquaculture has different consequences for planktonic food webs in the water column.

Questions

Q: How sure can the consumer be that the product is actually organic?

A: A product cannot legally be sold within the EU unless it is certified by an official organic certification body.

Q: What are the rules on vaccines within organic certification?

A: There are not specific rules under the EU regulation but vaccination needs to be approved by the Commission and the specific certification body needs to have a veterinary management plan. The guidelines on animal health management are primarily based on the prevention of disease.

Q: Is the difference in nutritional profile between conventional and organic feed related to density?

A: There are many factors which lead to the differences between organic and conventional feed, but we found that the nutritional profile of organic feed is much more similar to the amino acid profile of the fish product. Organic aquaculture is a relatively new field of organic production compared to organic agriculture and more research will provide new knowledge on feed ingredients or stocking densities.

Speaker 3: Andrea Fabris (Associazione Piscicoltori Italiani)

Good Practice example: "When the environment needs aquaculture: Valliculture"

Andrea Fabris discussed valliculture (aquaculture in brackish wetlands), a traditional extensive cultivation technique which utilises the large areas of productive brackish waters for fish production. Fixed fish barriers are used to contain the fish with minimal human intervention. The brackish waters are used as a 'nursery' with the fish harvested when they return to the sea.

Valliculture performs a valuable ecosystem service, such as providing food resources supporting biodiversity for nearby Natura 2000 sites. It also represents a social, cultural and economic heritage, which is profoundly linked to biodiversity and ecosystem preservation. Its status, however, is under threat from legislative restrictions.

Questions

Q: You mentioned that public opinion of valliculture is not great in Italy, why is this?

A: The product is sometimes mis-sold as conventionally fished and fishermen are not happy with this.

Q&A Session:

Cristina García Díez (*Spanish Aquaculture Observatory Foundation*) commented on the process of aquaculture licensing in Spain. The adoption of separate licensing processes in each of the 17 regions, each with different selection criteria, increases bureaucracy and makes it difficult for

licences to be issued. It would be useful if guidance was produced to help administrators determine which practices were acceptable and to help them guide applicants through the licensing process. Advice and guidance is produced on a national level but is not filtered down to regional level.

Luz Arregui Maraver (*ESACUA- Spanish Freshwater Aquaculture Producers Association*) highlighted the shortage of freshwater aquaculture licences being granted in Spain. The process is complicated, there are numerous licences that need to be obtained and the process takes an unacceptably long period of time. It was asserted that the process relied heavily on the judgement of individual administrators, hence was subjective leading to high variation in the duration of the application process. Administrators were judged to be overly cautious and wary in the way that they would be liable to grant a licence to an operator that may later cause environmental damage. It was claimed that aquaculture operators receive little protection yet in other food producing sectors it seemed that resources are damaged by the tolerance of illegal agriculture activities.

Guzel Yucel-Gier (*Institute of Marine Sciences and Technology, Dokuz Eylül University*) questioned whether the potential for harmonisation of the standards for monitoring and licensing was a realistic goal, given the drastic differences in the state of aquaculture development between member states.

LUNCH

Speed presentation Speaker 1: Dr. Panayotis Panayotidis (Hellenic Centre for Marine Research [HCMR])

Spatial planning as good environmental practice for aquaculture: the case for Greece

Dr. Panayotidis explains how the use of zonation makes it easier to apply the WFD. Monitoring within Greece takes place on a regional scale within zones. The zones are not officially set out, but this allows the cost of monitoring to be divided between a number of aquaculture operators.

Questions

Q: How can aquaculture avoid *P. oceanica* beds?

A: Aquaculture sites cannot be located in an area where there is *P. oceanica*. Some older farms had been placed near these beds before this rule was brought in and have caused damage, but where *P. oceanica* remains these farms are in the process of being relocated.

Speed presentation Speaker 2: Dr. Konstantinos Koutsis (Hellenic Ministry of Rural Development & Food - Directorate for Aquaculture)

Examples of good practice improving environmental performance in Greece

Dr. Koutsis outlined a number of measures that have been put in place in Greece to increase aquaculture sustainability. Implementation of a carrying capacity formula was enacted in 2009, for adjusting the production capacity of the existing and new marine farms based on 4 parameters: 1) occupied marine area, 2) distance from shore, 3) average depth of the occupied area, 4) speed of currents. In addition, spatial planning has been incorporated into the licensing process to control where farms are located. This includes controls to prevent farms being located near *P. oceanica* beds. Stakeholder engagement has been an important part of implantation of these reforms to avoid possible conflicts of interest.

Break out Groups

Question: What constitutes good practice for ensuring better environmental performance across all types of aquaculture in the context of the WFD and MSFD?

Group 1: chaired by Chris Vivian (Cefas)

Points that were noted:

- A willingness at all levels. e.g. from the general public, within supply chains, at a political level etc., to improve practices;
- Strategies should be implemented in accordance with their priority rather than attempting to address everything simultaneously;
- The process should be transparent and inclusive;
- Stakeholder involvement should be maximised where possible;
- There should be clear links between the strategies and objectives of the WFD and the MSFD;
- Monitoring should be limited, only to parameters that could effectively detect adverse impacts from aquaculture. Need to look at what is really appropriate to measure. Examples of unnecessary monitoring currently in place include the measurement of heavy metals in water when it would require an unrealistic level of contamination in order to exceed levels of contamination;
- There should be more balance across the three pillars of sustainability;
- Differences of interpretation seem to lead to differences in implementation;
- The management of diseases, environmental impacts, escapees and the use of medicines should be addressed collectively with a fully integrated holistic approach;
- Funding should be prioritised to favour sustainable aquaculture;
- Feed conversion ratios and 'fish in fish out' requirements must be understood in the context of the species and the farming system;

- Measures should be taken to ensure aquaculture receives fair access to water resources relative to other industries such as agriculture;
- The WFD should be linked to Common Agricultural Policy funds;
- Training should be provided to increase awareness and understanding among administrators of aquaculture and sustainable aquaculture practices;
- There should be more effective enforcement of laws and regulations;
- Priority should be given to biological over chemical monitoring;
- The monitoring of molluscan shellfisheries should be used as a proxy for impacts on human health.

Group 2: chaired by David Verner-Jefferies (Cefas):

Points of note:

- Good practice should take local context into account;
- There should be more balance between the emphasis placed on three pillars of sustainability;
- Good practice should consider social aspects such as job creation;
- There should be more consistency between member states in the implementation of the WFD and MSFD;
- Administrators should be provided with guidance for licence renewal in addition to the initial application process;
- Measures should be taken to reduce the complexity and regulatory burden of the regulatory process;
- There should be a greater level of consistency in the monitoring that is carried out by different member states;
- Greater consideration should be given to spatial planning. Specific activities could be limited to appropriate areas for aquaculture; co-location should be adopted more frequently; benefits to local communities should be considered when deciding where to locate activities; monitoring responsibilities should be divided between all local resource users.

Group 3: chaired by Adrian Judd (Cefas):

Points noted:

- There should be greater consistency in the implementation of legislation;
- Regulatory criteria must be proportional to risks;

- There is a need for better communication with administrators, and release of information. Stakeholders feel they do not have access to information or data;
- Indicators should be selected to best establish who is responsible for specific impacts;
- Barcelona Convention strategy documents do not encourage collaborative working, but collaboration is of key importance;
- There is a need to produce good practice standards in order to manage local issues on a case by case basis;
- More guidance should be provided to help identify performance indicators; e.g. to assess where data can be found, who holds it, how accessible is it etc.;
- Greater access should be provided to mapping data for fisheries, habitats, species etc.;
- Communication between data holders should be improved in order to ensure that similar data are stored together and are not spread across numerous locations;
- Data cataloguing should be introduced to identify what data sets exist, where they are held and how they can be obtained/shared;
- There is a need for greater consistency in the standard of EIAs for aquaculture. Regulation should ensure that good practices are shared across member states;
- Monitoring requirements should be enforced in order to achieve a greater level of consistency.

Speaker 4: Dr. Anastasia Miliou (Institute of Marine Conservation)

“Ecosystem impacts of intense aquaculture practices in the Aegean Sea, and our proposal on sustainable practices.”

Dr. Miliou provided a case study of the impacts that can result when aquaculture operations are not managed in a sustainable manner.

The Oinousses Island Complex is a region that supports many important protected species and habitats including extensive areas of *P. oceanica*. Following the introduction of a law (POAY) allowing a 100% increase in aquaculture production in the region, a comprehensive study was carried out to demonstrate the likely environmental consequences of the proposed increase. Dr. Mililou emphasised the importance of selecting appropriate locations for aquaculture operations and the need for a local context when determining carrying capacity.

Questions

Q: Was this research funded by private or public funds?

A: Private donations from local communities.

Members of the audience commented that this example should be seen as an exception rather than a common occurrence.

Dr. Miliou agreed and repeated that the presentation was intended to illustrate the negative impacts that can occur when good practice is not followed or when carrying capacity is not calculated correctly.

Speaker 5: Dr. Güzel Yücel Gier (Institute of Marine Sciences and Technology, Dokuz Eylül University)
“A case study of identifying indicators for sustainable marine aquaculture in Izmir/ Turkey”

Dr. Gier discussed aquaculture production in Turkey. A law passed in 2006 required farms to be located ≥ 0.6 miles from land, in depths of ≥ 30 metres and at sites with a TRIX value (a composite trophic state index) of >4 . These changes were prohibitively expensive for many small operators and caused a restructuring of the aquaculture industry towards fewer, larger, producers. Since this time, production and economic value of aquaculture in Turkey has increased drastically.

Dr. Gier discussed a study carried out to assess the sustainability of aquaculture in Turkey, which takes into account environmental, social and economic indicators, emphasising the equal treatment of all three aspects.

Q: Certification was mentioned. Who provides this?

A: The certification is private, and independently audited.

Q: What is the TRIX indicator, and why is it a powerful indicator?

A: The TRIX indicator provides a formula to calculate the risk of eutrophication and is more useful than other indices when deciding upon the best way to progress in future.

Speaker 6: Dr. Cristina García Díez (Spanish Aquaculture Observatory Foundation)

“Mediterrane-On: Sustainability indicators for aquaculture sea cages in the Mediterranean”

Dr. Christina Díez discussed ‘Mediterrane-On’, a multidisciplinary tool that allows the sustainability of aquaculture operations to be gauged. The tool uses a range of measurable indicators to ensure aquaculture operations are environmentally acceptable, socially equitable and economically viable. Indicators were developed around the three pillars of sustainability: social; economics; and environment, and at three levels of stakeholders: companies; governments; and international organisations. Each indicator is given a score out of to five to produce an overall measure of sustainability.

It is hoped that the 'Mediterrane-On' can help simplify administrative procedures, secure sustainable development and growth of aquaculture through coordinated spatial planning, enhance the competitiveness of EU aquaculture, and promote a level playing field for EU operators by exploiting their competitive advantages.

Speaker 7: Dr Gianluca Fiore (Joint Research Centre of the European Commission)

"Aquaculture farming, 14 years after the Naylor et al paper (Nature 2000)"

Dr. Fiore summarised how the development of the aquaculture industry has occurred, compared with the predictions within the milestone Naylor *et al* (2000) paper. This paper warned of potential environmental damage and damage to fish stocks from expansion of the aquaculture industry and suggested that the potential contribution of aquaculture would be limited due to a reliance on farming of carnivorous species.

Dr Fiore explained how advances such as a reducing reliance on fish meal/fish oil and an increase in the production of herbivorous freshwater species have avoided some of these predicted impacts. Dr. Fiore also emphasised that farming is a more efficient way to produce carnivorous fish species than wild catch. Farmed species expend less energy to obtain the same amount of feed than their wild counterparts and so require less feed.

Dr Fiore explained that aquaculture is a far more efficient source of protein, when compared to terrestrial farming, with respect to water and land use and can play an important role in meeting the protein demands of a rapidly increasing population. If managed correctly impacts from aquaculture could be considerably lower than those terrestrial farming systems.

6th May 2014

Morning session

Speaker 8: Dr. Nikolaos Anagnopoulos (APC Advanced Planning Consulting S.A.)

"Implementation of the MSFD and WFD in relation to aquaculture"

Aquaculture is an important part of the Greek economy and plays a significant role in the balance and maintenance of the aquatic environment. Dr. Anagnopoulos explained how the WFD has been incorporated into river basin management plans (RBMPs) in Greece. The RBMPs assess the most important human pressures on water resources, and set out a monitoring programme for the assessment of ecological and chemical status of water bodies, list of environmental targets for the water bodies, set out economic assessments of water use and establish programmes of measures in order to achieve targets.

Dr. Anagnopolous continued that the MSFD requires member states to develop strategies on a regional scale and Greece has introduced spatial planning for aquaculture operations. Areas for Regulated Aquaculture Development (ARAD) are now included in the Register of Protected Areas as “Areas for the protection of aquatic species of economic importance”.

Mr Anagnopoulos explained how marine strategies were prepared and established and outlined the process of developing and introducing measures in order to achieve good environmental status (GES-MSFD). The next stage is the introduction of a monitoring programme for ongoing assessment and updating of targets.

Speaker 9: Luz Arregui Maraver (ESACUA- Spanish Freshwater Aquaculture Producers Association)
“Implementing the WFD in Galicia Costa (NW Spain) in the fresh water aquaculture sector”

Dr. Maraver discussed the challenges facing freshwater aquaculture in north-west Spain.

Aquaculture within Galicia is not considered to be a priority with respect to water use and is ranked 5th in the list of priorities within reports produced for the WFD, compared with agriculture which is 2nd. Galicia has a Hydrological Plan, but this runs to more than 5,095 pages of which only 60 pages deal with aquaculture.

Many other projects have been permitted by the authorities which could potentially conflict with aquaculture operations, e.g. hydro-electric plants and reservoirs. There is tolerance of widespread illegal water use, particularly within agriculture, and there are many illegal wells in Galicia, although the authorities are starting to locate and regulate these points of abstraction.

Dr. Maraver explained that fish farms are generally well run with minimal environmental consequences. When compared to agriculture, aquaculture uses smaller volumes of water per unit of output and releases less nitrogen and phosphorus based pollutants.

Environmental flow (EF) is frequently used as justification for water restrictions; however there are various deficiencies in the methods used to calculate EF and calculations are frequently based on short term datasets. There is a currently open consultation in Galicia on EF, and there are some serious issues for aquaculture, such as the quality of data on which the authorities are basing estimates is poor, and there seems to be an apparent requirement for trout farms to avoid abstracting water over a 3-4 month period every year.

Speaker 10: Philippos Papageorgiou (Kefalonia Fisheries SA)

“Mediterranean Fish Farming: to grow, or not to grow?”

Philippos Papageorgiou discussed the considerable potential of EU aquaculture production but warned of the challenges that must be overcome in order to maximise production. Global demand for aquaculture products and overall aquaculture production is increasing rapidly but Mediterranean production is not growing at the same rate.

Mr Papageorgiou emphasised the need for level playing field with regards to imported fish products and outlined the steps required to achieve sustainable growth of the EU aquaculture industry. The process is currently too lengthy, bureaucratic and complicated and EU producers are losing out to Asia competitors with a less strict regulatory framework in terms of environmental and social (employment rules) protection, product quality and assurance, and ultimately with far lower costs. There is high potential for growth within the EU; however this will require the implementation of development strategies for growth, simplification of the administrative process, guarantees of equal access to water and other resources for aquaculture producers and the maximisation of technological expertise within Europe. It is important to ensure that Member States have a common understanding of the EU regulatory requirements and how these should be applied within industry.

Speaker 11: Andrea Fabris (Associazione Piscicoltori Italiani)

“Creating Frameworks of Good Practice”

Dr. Fabris discussed the challenges of developing frameworks for good practice for EU aquaculture. The current processes are overly bureaucratic, place many unnecessary burdens on both administrators and the industry, and allow inconsistencies in processes in different member states. Dr Fabris outlined the factors that are required in good practice frameworks for the implementation of the WFD and MSFD, explained what steps need to be taken to make legislation more straight forward and easier to adopt and provided examples of good practice and areas that need to be developed in the future.

Speaker 12: Katie Miller (ClientEarth)

“The Sustainable Seafood Coalition: A voluntary approach to best practice”

Ms Miller talked about the Sustainable Seafood Coalition, a cross-industry group working to produce a code of guidance for the labelling of seafood within the UK.

The voluntary scheme has been developed with major retailers, processors, restaurants and other supply chain stakeholders. The group has drafted two codes of conduct for best practice with relation to responsible sourcing and consistent labelling of products.

The Coalition has reached an agreement that only the terms about 'sustainability' or 'responsibility' will be used in relation to fish products and the definition of these claims have been clearly defined. It is hoped that this scheme will complement legislative measures such as the MSFD, will increase consumer clarity (and therefore confidence) in products and will ensure additional benefits such as speed of change. The code of conduct has been reviewed by experts from areas outside the membership and is currently undergoing public consultation.

Q: How will this scheme tie into current legislation regulating advertising claims?

A: Current legislation makes it difficult for claims to be proven to be wrong or misleading. There are no requirements or minimum standard. The Sustainable Seafood Coalition clearly defines the criteria for claims.

Q: The scheme mentions third party certification. Can you provide examples of these for aquaculture?

A: Independent audited chain of custody, all certification bodies etc.

Q: Do you have any aquaculture producers involved?

A: Not yet, but it is hoped that this will happen in the future.

Q: Are there any plans to expand this into other member states?

A: ClientEarth do not have the capacity to do this, but the organisation would look to encourage this or potentially seek funding if any other body was interested.

Panel Q&A

Irmak Ertör (Foundation ENT): The growth of aquaculture has been linked to social development and job creation. Many of the panellists have suggested that industry growth will lead to increase in jobs. However, job growth may not increase directly together with industry growth. (e.g. 50% increase in output will not necessarily lead to 50% increase in jobs). Some members sceptical of this, others say that legal framework can be used to prevent this.

Elena Mente (University of Thessaly): A recent study has shown a willingness of fishers to move from fishing into aquaculture. Therefore this industry has the potential to provide new jobs for these people.

Various attendees emphasised that this demonstrates conflict between different types of growth, and conflicts such as this should be highlighted and addressed within the WFD.

Anna Cheilari (European Commission, DG Environment, Unit C.2 "Marine Environment & Water Industry") clarified that this point is not within the project remit.

It was highlighted that there has been very little reference to shellfish throughout the conference.

Luz Arregui Maraver (ESACUA- Spanish Freshwater Aquaculture Producers Association): The RBMPs deal with rivers up to the sea, but coastal or estuarine areas are not considered sufficiently, leading to a lack of attention on shellfish.

Speed presentation 3: Helen Karka (Ministry for the Environment, Energy and Climate Change, Greece)

"Spatial planning for aquaculture: a special national framework for resolving conflicts"

Dr Karka outlined a plan for the regulation of spatial organisation of freshwater and marine aquaculture operations. The plan provides guidelines for the location of fish farms based on a zoning principle whilst recognising the need for special consideration in certain cases.

Dr Karka provided examples of the implementation of this plan and reasons why applications may or may not be accepted on grounds of location. The use of production zones was discussed and how this can be implemented without causing irretrievably environment damage.

Break out groups:

Effective and cost-efficient transposition and implementation of the WFD and MSFD for aquaculture

(There were only two break-out groups on the second day)

Group 1: *Chaired by Chris Vivian (Cefas):*

Points noted:

- The existence of freshwater aquaculture can be used as a test for water quality. In some areas drinking water is provided after it passes through aquaculture operations, without causing harm. Under some circumstances, the presence of aquaculture operations may be seen as an indicator that the area has high water quality;
- Measures for the implementation of MSFD need to specifically target the issues that you are trying to address;
- There is a need for clarity and public participation in the implementation of WFD and MSFD;
- The impact of measures should be quantified (e.g. through an EIA) before they are implemented;

- There should be risk based approach to determining the need for monitoring (e.g. in France aquaculture operations below a certain level are not required to carry out tests on effluents);
- Spatial planning: good idea in principal, but it is important to take care in the implementation;
- Water use should take all uses into account inc. farms, and other terrestrial operations which output into the water. Priority should be given to nitrogen balance;
- Member states are misinterpreting the WFD and requiring tests of individual operations and justifying by saying it is required under WFD;
- Monitoring should be science based (i.e. should not do unnecessary tests), cost effective and efficient;
- The encouragement of voluntary schemes will help with the implementation of the WFD in a cost effective manor (to both the member state and the specific organisation);
- All environmental licensing processes should be combined into a single one (e.g., water use, effluents etc.) regulator.

Group 2: David Verner-Jefferies (Cefas):

Points noted:

- The WFD is limited to one nautical mile offshore (i.e. offshore & inshore aquaculture), therefore it is necessary to consider other users. The TRIX index could be used to allow better integration between WFD & MSFD with respect to environmental monitoring;
- It is important to understand data from EIA/SEAs and how these can inform decisions / work on GES (WFD or MSFD);
- There is a need to agree EQS for different regions and species, and should be location specific;
- An adaptive strategy is needed in high production areas or if there is a history of 'bad' practice. This may trigger more intensive / detailed monitoring. Also, may need different criteria (site / location based);
- Scale is critical in addition to contextual parameters such as temporal temperature, salinity, suspended sediments etc.;
- Monitoring should be targeted at the issues relevant to specific sectors;
- There is a need for data cataloguing to specify where data can be found e.g. antibiotics, feed usage, discharges etc.;
- Monitoring data should be collected / stored in standardised way;

- Sampling strategies, frequency, intensity, etc. should be standardised;
- Water quality upstream & downstream should be compared i.e. what is the real contribution of aquaculture (this could also apply to other parameters);
- Modelling tools should be improved & validated in order to improve confidence (transparency of communications of models processes and outputs);
- There should be a greater level of data sharing and agreed methods for data authentication;
- Simple mechanisms for feedback from stakeholders / communities – iterative and continual;
- Conflict resolution mechanisms should be tied to appropriate monitoring in an inclusive process of communication (i.e. without a legal focus which may deter open dialogue);
- The development of approaches for integrated assessment & monitoring should be linked to / build on EU funded projects & work in ICES.

Dr Auchterlonie, closed the workshop by thanking the speakers for an excellent round of high quality presentations, the attendees for the input and comment, and the Ministry for Environment, Energy and Climate Change in Athens for the provision of the venue.

Annex 4: Minutes of the Black Sea and Danube Regional Workshop (Vienna)

Danube & Black Sea - Good Practice Workshop (especially freshwater aquaculture)

20th and 21st of May 2014

Vienna International Centre (VIC), C-Building on the 7th floor; Room (C-C3)

Wagramer Strasse 5, 1400 Vienna, Austria

“Exploring good practices in improving both environmental performance in aquaculture and cost effective implementation of WFD & MSFD”

Final Meeting Note

Day 1: Tues 20th May

Welcome – Ivan Zavadsky (Executive Secretary, ICPDR Secretariat)

The International Convention for the Protection of the Danube River (ICPDR) was signed in 1998 to cover all the Danube tributaries and the entire river basin. ICPDR provides an implementation platform for the WFD with 14 European states and the European commission each provide a chairperson each state for one year on a rotational basis. The ICPDR also enables the 5 non-EU members around the Danube to use the same platform for voluntarily implementing WFD as the other EU Member States (MS).

Pollution was key challenge for the Danube region in the past (particularly nutrient pollution- EPITR). The Danube Sturgeon Task Force (DSTF) was set up to protect genetically pure and healthy sturgeon stocks and their essential habitats. The main goals of the Danube region are to implement the second phase RBMP under WFD (2015) with basin wide consultation processes. This will include enabling the growth of aquaculture businesses by addressing challenges and developing opportunities.

Introduction to the project and the aims of the workshop, Keith Jeffery (Cefas). See Dublin meeting note for greater detail. Introduction from the Cefas panel.

Speaker 1: Lourdes Alvarelos (DG ENV).

'Implementation of the WFD: aquaculture areas in the River Basin Management Plans'

Following the implementation of the WFD, the directive includes several articles directly relating to the development of aquaculture, including Article 4.1.a. establishing the environmental objectives

[Background information for sustainable aquaculture development, addressing environmental protection in particular \(Part 2\)](#)

for surface waters, Article 4.1.c. to achieve standards and objectives of protected areas within 15 yrs, Article 6 requires MS to build a register of PA's with explanations of why they are protected, and Article 4.9. which allows for exemptions but offers only extensions of time to compliance and not an excuse for non-compliance. Shellfish waters are protected areas after repeal of the Shellfish Waters Directive, so many national microbiology standards and transposing shellfish legislation have been retained by MS after the SWD repeal, in order to retain at least the same level of protection as the repealed directive as required by the WFD. The Commission's assessment of first RBMPs in 2012, concluded that additional objectives and measures for the aquaculture areas have been established in many RBMPs. However, these are generally not clearly reflected in RBMP's. For the next phase there should be a better integration of aquaculture activities into RBMP's to enable transparency and allow for better management at river basin scale. The Commission is having bilateral meetings with all Member States, and the issue of aquaculture is raised whenever relevant, in order to improve implementation for the next cycle of RBMPs. The last resort is infringements procedures if legislation is not complied with.

Session 1 Good practice examples: how to improve environmental performance in practice: an industry perspective.

Speaker 2: Key Note Speaker, Bernhard Feneis (FEAP)

"WFD & Aquaculture, a contradiction in terms or potential for a symbiotic relationship?"

German aquaculture produces 9000 tonnes of fish including mostly carp, and rainbow trout including all fishes going to open water systems which are fish not usually included in official calculations. Often extensive pond systems belong to a different farms- and it can take up to 10 years for water to pass through the farms and back into the river. A big problem for carp production in these types of ponds is predation by otters, as the fish in the ponds are the result of a long term (up to 50 years) selection and development procedure breeding scheme which cannot be replaced or bought again. The WFD is not applicable unless individual ponds or farms are >50 Hectares. Council Directive 2006/88 for aquatic animal health requirements places statutory pressure on aquaculture. Under WFD, the biological criteria for Good Ecological Status are aquatic/marine biotic communities which include macrophytes, phytobenthos, fish, macrozoology and predators (e.g. Cormorants which can heavily predate fish in rivers despite restocking attempts). Chemical criteria for Good Chemical Status includes nitrogen levels but when measured nationally against other sectors Germany's pond aquaculture does not contribute nitrogen or phosphorus in amounts that

are measurable for the WFD to open/surface waters. The main sources of nitrogen to surface waters are from erosion, drainage, groundwater and urban waste water.

Problems for expanding aquaculture include; 1) differences between National Strategic Plan and realistic possibilities 2) No licenses available for using extra water, 3) no possibilities to eradicate predators (e.g. otters, cormorant, herons) 4) unlevel playing field and production conditions (e.g. can import carp from Lithuania cheaper than growing in Germany via expanding businesses) 5) produce at one standard and consume at the other, 6) food costs for fish meal and fish oil. The meaning of sustainability should be the development of the aquaculture industry without reducing what the industry needs for its future survival and expansion. WFD has no conflict with aquaculture, but often the lowest level of administration decides whether to issue aquaculture licences, with the WFD often misinterpreted. There are contradictions between WFD and 2006/88. Topics of concern are that the Aquaculture industry is not an objective of the WFD and appears insignificant from WFD view, and that WFD is poorly communicated by scientists. Often fish farming is in areas of favourable status for conservation and WFD is about ecological functionality.

Trout production as a sustainable production example: public funding was unavailable so one initiative from farmers/industry was to reduce the amount of electricity consumed during aquaculture production, including calculating where and how much electricity was used per kilo of fish produced. Consequently producers now use the natural water gradient within a farm to move and regulate water and oxygenation without electricity. There are high costs involved in running electric oxygenation systems. However, it is possible to remove some carbon dioxide and oxygenate just by using gradient flows. Other efficiencies implemented to reduce the use of electricity include: use of raceways, control and monitoring to switch equipment on/off, making equipment more efficient, and downsizing equipment e.g. pump size. Feed losses must be minimized to reduce wastage and costs. Feeding times can be minimised and/or automated to save manpower to compensate for use of electricity. Example site photograph shows the addition of a roof over the fish ponds which achieves multiple benefits including shade for improved trout welfare, protection from bird predation, improved working conditions for humans and it is also possible to cover the roof with solar panels which can produce more energy than is consumed. The type of energy used affects the success of aquaculture business. To aquaculture producers it is preferable to be 100% CO₂ neutral (cheaper) rather than be organically certified (expensive) by labels, as consumers usually buy based on lower price. Aims to further increase sustainability of aquaculture include developing methods of producing oxygen and then storing it overnight, reduce fossil fuel consumption in cars/tractors or

compensate for fossil fuel use by producing more solar power than is used on the farm, and aim to reduce Fish In Fish Out (FIFO) to <1 (2 suppliers of trout food guarantee 0.95 FIFO).

Social affairs are also tied to the sustainability of both ecology and economy. Long term workforce employment of longer than 10 years qualifies employees for additional pension and money which ensures an element of social sustainability. WFD does not help sustainability as it is only ecology based and does not include a sustainable economy and social aspect. WFD is a regulatory framework for managing water resources but there is a view across Europe (including Czech Republic, Poland, Germany, Austria, and France) that WFD is not helpful for sustainable freshwater aquaculture.

Speaker 3: Daniel Tabacaru, (Innovative Farm Caviar Factory)

"Zeolites the Aquaculture Holy Grail"

Attendees were shown a film of the Danube Sturgeon; Low cost sturgeon aquaculture technology includes recirculation system without heating or cooling, with remotely controlled conditions, mechanical and biological-filtration removing wastes and solids from fish food waste and excretion and computerised monitoring of the water parameters. This example of super-intensive aquaculture enables 3 tonnes/4000 fish to be bred on a small site. Since there is an embargo on Danube sturgeon fisheries, aquaculture is relied upon to supply sturgeon for the market. Investment in fish farming brings long term environmental and social benefits as private research to develop aquaculture feeds back into sturgeon biodiversity conservation research required to revitalize the wild sturgeon recovery programme.

At the Caviar Factory 3200 kg of fish are grown in 64 m³ of space producing 50/kg of fish per cubic metre. The operation is sustainable as it only uses 64,000 litres of water, has low energy consumption of 2.3 kw/h. Filtration is by mechanical means to 40 micron and by using zeolites and electrochemical processes. Zeolites are volcanic ash which has a high affinity for ammonium when formatted with NaCl. They act as molecular sieves therefore don't need to use bacteria or nitrification filters (however they do use electricity to 'recharge' and therefore the zeolites are not used up and can be recharged and reused). Removing 1 gram of ammonium requires 40 watts of energy. Waste removal costs are approximately 38.44 cents per kg of fish which is less than using UV sterilisation. This process does not need UV because of a pH change from 6 to 12 ensures that bacteria do not survive. The electrolysis process results in chlorine, filtered with thio-sulphate and charcoal. The next project to improve sustainability is to utilise solar power to provide energy for electrolysis and software operation. Automation reduces labour and costs.

The industrial production of fish feed and discharges containing undigested food waste from fish farms are known to be environmentally damaging. The sustainability of this operation is increased by innovation of use of natural food types (as sturgeon in their natural habitat eat insect larvae) the insect larvae of *Tenebrio molitor*. Denmark and Holland use these insect farms for growing food for birds and lizards, but this is not known for fish farming. The insect larvae can be grown on poor quality grain which is not suitable for flour use. The use of 10 tonnes of low quality grain (1kg of grain is worth 0.125 Euro) achieved 5600 kg of larvae (from 200 males and 200 females) over five years due to their short life cycle of 90 days. The natural food contains everything that industrial food does not, including minerals, fatty acids, and nutrients from the grain and even the insect faeces are used as an agricultural fertiliser.

Speaker 4: Ferenc Lévai Jr. (Aranyponty ZRt – Deputy Manager)

Sustainable carp farming and the WFD

Ferenc is a representative from FEAP, Aranyponty fisheries company and the Hungarian fish farmers association. Pond farming is economically, socially (rural livelihood), ecologically (habitat for wildlife) and historically (museum for education) significant. Carp is not popular as a food fish across the EU, except in the eastern EU where it is a traditional food. 70,000 tonnes of carp are produced across EU (fluctuates). There is not great potential for growth in carp aquaculture as there is not increased demand from consumers but the process of production is sustainable as it is low density production and fish meal free (no FIFO). Aranyponty is 1400 hectares of fish ponds producing 1500 tonnes of market size fish (80% carp) These carp ponds offer environmental services (water quality and purification effects, phosphorus and nitrate retention, water management and water retention services e.g. irrigation and flood control, wetland habitats, increased biodiversity) appropriate to the WFD objectives as they are RAMSAR and Natura 2000 areas, plus ponds are also a national park, so aquaculture producers work in cooperation with environmental NGO's and authorities. Aranyponty also offers eco tourism (fish restaurant, accommodation, fish festival social events, conferences, workshops and training, museum, wetland school and children's camps). This aquaculture good practice example demonstrates the potential of mutual benefits of WFD and aquaculture.

Panel questions & answers

Comment: From the perspective of an ecologist of wild fish stocks; low fish stocks are not solely due to predators but also due to migration barriers and human impacts.

Comment: Projects have identified the damage caused to aquaculture ponds by cormorants. Aquaculturists can protect ponds but at great cost using manpower and equipment. Other countries

have bigger problems e.g. French businesses have shut down due to cormorant damage. There are scientific studies demonstrating that cormorants alone are affecting natural water bodies. Local angler associations have rebuilt spawning areas for fish which is successful as new larvae and small fish are observed however over winter all the fish are taken out by cormorants. In the Danube there are large fish in the river, but over the winter predators are removing many young fish.

Q. The speaker mentioned that they have had problems with environmental NGO's – which were these? As it is known that WWF and Greenpeace are promoting/agreeing on carp production.

A. It is mainly small local NGO's wanting to protect local parts of Germany and Bavaria, putting lots of pressure on local administrators and creating publicity to get money for their NGO. There is less problems with larger NGO's. The NGO's often misinterpret data and use emotional thinking not scientific discussion.

Comment: Please will the speaker amend their presentation to reflect this local NGO problem.

Q. The speaker mentioned that the water from the aquaculture ponds goes back to the river but is it cleaned before discharging and do they measure nutrient concentration (regarding eutrophication)?

A. Yes the producer is obligated to clean up the water to obtain a licence. Large farms measure nutrient content automatically. Cleaning ponds are located behind the production ponds which enable a reasonable effluent water quality to be produced. Microfilters can be added relative to the production levels of the ponds. The water is emptied once a year into another pond and it is decided by the administrators how fast it can be drained to harvest the fish.

Q. Do you provide medical treatment for the fish and then measure this in the effluent?

A. There is generally no medical treatment in carp farms in Hungary. Early stage rearing sometimes uses medicine for parasites (only once every 2 or 3 years when necessary and only in a <1hectare nursery fish pond).

A. Germany doesn't administer drugs to carp as due to the low intensity production, the fish don't have parasites, therefore drugs are not needed. However producers technically could use drugs as a one off event if they were required. Trout production would only need 20kg of antibiotics for 3000 tonnes of fish (which is almost nothing compared to pig and cattle production). Reduced further as factory can't produce less than 2 tonnes and no one can store it. Vaccinations are carried out for ERM, VHS and IHN Germany take a preventative approach instead of requiring medicines. The carp don't have either endo or ecto parasites, and there is not a sea lice problem in the farmed trout (as is reported as a problem by other EU countries farming salmon).

Q. Can you use Zeolites in other situations other than freshwater?

A. No only in freshwater systems– not in marine situations. They could possibly be used in small ornamental aquaria but not marine aquaculture. In a flow-through situation it would be possible to use zeolites to control effluents from a farm.

A. The reason why we (Caviar Factory, Romania) stopped using nitrification to transfer ammonium waste into gas is because of the number of antibiotics we needed to use. There are very few sturgeon vets so when they were suffering *Aeromonas* infection, the producers used to have to use antibiotics, which then killed their bio-filtration. Now we don't need to use any treatment as we use clean water from underground boreholes, clean the air we use, and ask visitors not to put their hands in the tanks to keep out diseases.

Comment: There is EU legislation regarding which medicines can be used for EU product but these legislative requirements do not apply to imported products.

Q. During the process of WFD as aquaculturists how were you consulted in preparation of WFD?

A. Hungary – Consultation regarding national legislation and implementation of EU legislation is very good so we can't complain. Of course there are always certain regulations that you don't agree with but no problems with consultation.

Germany – ministry level involvement is very good but at a local level farmers need to go to local meetings to have any influence. 80% of production is from 10% of producers. Other producers are much smaller and due to lack of education often don't realise that they have to influence local authorities. Individual engagement is necessary.

Q. Does the diet of sturgeon affect the quality or taste of their caviar?

A. The quality of the feed is same as their natural wild diet. Industrial feeds are more complicated to treat/filter/clean in the pond system. The larvae are 95% digestible and are liquid apart from their exoskeleton. Sturgeon has problems assimilating industrial food. For more information on sturgeon feed visit the Caviar Factory website.

Comment: Romania reported that for the first time police arrested 120 people, search 48 locations for illegal wild sturgeon poachers and captured 4 tonnes of sturgeons, 80kg of caviar and 100km of net.

Q. How old are the sturgeons when they produce good caviar?

A. Out of the 27 species of sturgeon, the species used in this system in Romania are the smallest sturgeon in the world, reaching 10kg maximum at maturity. They mature in 6 years in natural habitat however in aquaculture systems they can mature in 4.5 years as sturgeons hibernate over winter, automatic adjustments can shift the days through temperature and light faster than usual to suggest to the fish that years have passed.

Q. How much space do you need to grow *Tenebrio*?

A. 500 m² as you need to store the food grains and sanitize cages and protect the area.

Q. What parameters are you looking at for water quality effluent treatment standards?

A. Larger farms measure effluent water quality consistently or the administration takes samples. It is the administrators who specify what should be measured; up to 10 parameters according to production level, including Nitrogen and Phosphorus.

Q. Will it be easy to achieve standards worldwide for trout farm effluent or is extra investment needed?

A. There are many different systems across the EU and some countries do not think in terms of sustainability e.g. in Turkey the government gives producers credit to build aquaculture farms and for exporting abroad without requiring filtering of effluents etc. We need to unify the approach across the EU to achieve sustainability.

Q. Why are only some sustainable forms of aquaculture green listed on consumer guides for consumers and supermarkets.

A. Greenpeace only recommended carp and not trout, as the mixed cage trout production in open waters systems is assigned the same group as the trout pond production. Emphasis on the sustainability of different production systems for the same fish species is needed separately for consumers, to better inform their choice.

Speed presentations

3 minute – 1-2 slide power-points presentations on specific examples of good practices of improved environmental performance.

Anna Wisniewska (Polish Trout Breeders Association and University of Warmia & Mazury)

“Aquaculture good practice in relation to WFD in Poland”

Aquaculture consists of mainly carp and trout in inland water bodies. Finance for improving environmental performance is available under the EU Common Fisheries Policy and Financial Instrument for Fisheries Guidance (FIG). Improved environmental performance is delivered in Poland through modernisation and diversification. The former being mainly for water purification) – e.g. installing micro sieves, self cleaning mechanical filter, automatic sludge removal) to reduced total Nitrogen and total Phosphorus.

Keys to delivering good practice in relation to WFD in Poland include: 1) Modernization of farms so that they reduce the pressure on aquatic systems 2) Active public consultation 3) Cooperation 4) Education of fish farmers (e.g. obtaining a degree in inland fisheries).

Jurgita Skorupskaitė (Ministry of Agriculture of the Republic of Lithuania)

“Nature management and water birds”

EFF offer compensations for signed up commitment to aqua-environmental requirements for 5 years (above normal good practice) including implementation of organic aquaculture farming, nature management and water birds protection. 19 out of 23 aquaculture ponds in Lithuania implemented the latter two measures. 16 farms of those farms do not fall under Natura 2000 so nature protection is voluntary. Compensation for these measures was paid from the EFF (6.66 million Euros). Good practice example: Raseiniu zuvininkyste – one of biggest ponds containing farmed carp and protected water birds between 2007 and 2013. Voluntary engagement is possible and yet farms can still maintain a successful profitable business. Benefits include positive effects on birds, improved landscape and compensation for farmers for loss of fish taken by increased bird predators.

Thomas Friedrich (University of Natural Resources and Life Sciences, Institute for Hydrobiology and Aquatic Ecosystem Management)

“Conservation hatcheries – A case study for Danube salmon and European grayling”

A big proportion of fish produced by aquaculture goes for stocking instead of human consumption. There are different requirements for fish for human consumption (fast growing) and stocking fish (fit for survival in the wild). Strict separation is needed between the two.

Danube salmon is produced for stocking by using wild brood-stock further, supplemented by wild catch to maintain genetic variability. Eggs are stocked into artificial nests. Aquaculture of European grayling cultures separate stocks from different catchments using wild brood stock. Young fish are released to their catchments early in life to enable them to adapt to wild conditions.

Szilvia Mihálffy (Ministry of Rural Development, Department of Forestry, Fisheries and Hunting, Unit for Fisheries, Aquaculture). *Best practice and innovation in freshwater aquaculture in line with WFD.* Hungarian trout aquaculture at Lillafured (handouts provided) has 1.2 Hectares with 18 tanks producing 36 tonnes of rainbow trout. Water is supplied by small creek which can dry out (or sometimes flood). Trout need fresh cold running water so the use of an open air recirculation system (with drum filter, trap tank, and bio-filter) enables the reuse of water, to secure continuous fish production and the potential to double production to 70 tonnes. The Barramundi farm at Jazskiser is the only farm producing this fast growing species in central Europe. Water is used to heat public buildings in the nearby village then used to heat water for aquaculture. This serves the purposes of the WFD, uses innovative technology and produces 60-70 tonnes of barramundi per year.

Pier Antonio (Associazione Piscicoltori Italiani)

"When the environment needs aquaculture: some examples from Italian Fresh water aquaculture"

Wetlands are an economic asset which increase biodiversity, act as flood protection and provide eco-system services. Freshwater wetlands in Italy are preserved through semi-intensive aquaculture. Lombardia and Piemonte regions also breed sturgeon for restocking rivers for biodiversity purposes not just for the market/table. Studies have been funded into increasing efficiency of water use and ensuring no substantial changes in water quality occur to ensure water bodies meet good environmental status. Trout burgers made from trout meat are being promoted as healthy locally produced food. EU needs to reduce imports in order to improve EU aquaculture.

Alastair Lane (European Aquaculture Society)

"The Lost EU Projects"

Lost EU projects e.g. AQUAS, SEAPURA, (seaweed to purify effluents from fish farm), Sustainaqua, Medveg, THRESHOLDS, aquae-treat. These projects produce excellent publications to communicate with consumers. Websites are often deleted after 5 years and links to electronic guidance manuals are lost, however these links could be hosted by dissemination partners websites or European websites (e.g. Eatip, Euroshell, Kg.eurocean). Reminder to preserve outputs from sustainable aquaculture projects and make sure they are suitable for target audience and future audiences to understand.

Dana Bedreaga (Delta plus)

"Improved water quality using solar feed spreaders"

A healthier environment produces healthier fish. This fish farm example of 100 ha, takes water from small stream and precipitation, and uses a flow-through system with cascades to circulate and partially aerate water to support 120 tonnes of fish in poly-culture. No fertilizers are used, and injection aerators are used only when needed. Solar powered feed spreaders are used to gradually feed fish in a more conservative manner so less food is wasted, and this also means waste products are released more gradually which leads to improved water quality, and enhanced fish health.

Franz Lahnsteiner (BAW) *“Strategies for breeding local autochthonous fish populations for aquaculture and for restocking in accordance with WFD”*

77% of Austrian native fish are red listed threatened species. Within Aquaculture some 3127 tonnes of food fish are produced, including 2212 tonnes of salmonids and 640 tonnes of cyprinids. Production of fish larvae for fish farms from egg to fingerling is commercially valuable for aquaculture and also for restocking purposes for ecological enhancement. Fingerlings produced for restocking and for regional fish farms are local fish strains which are known to show good survival, performance and reproductive success.

Questions

Q. Burbot were the last fish species to become extinct in the UK and it is now too warm in the UK to reintroduce it. What is the situation with Burbot in Austria?

A. They are endangered populations with the same problem as the UK as they require winter water temperature of 4 degrees or less.

Break out Groups

Discussion of what constitutes good practice for ensuring better environmental performance across all types of aquaculture in the context of the WFD and MSFD

Summary of break-out groups discussion:



Vienna- Break out 1-
Raw Good environme

Comment – The time for breakout groups was short so I need to add that the EU should give fish farmers more space for their own decisions as it is their investment and they feel strangled and will not invest further. Fish farmers can come up with their own solutions by investing their own money.

Comment- Other activities are affecting water quality but aquaculture also needs to be integrated into the river basin management plans.

Session 2 Good practice examples: how to improve environmental performance in practice: an NGO perspective.

Speaker 5: Margreet Van Vilsteren, North Sea Foundation

Good practices according to European Consumer guides – Freshwater.

Margreet introduced the North Sea Foundation (NSF); a Dutch environmental NGO working for sustainable use of the North Sea with all stakeholders via constructive dialogue that is driven by knowledge and not emotion. The strategy is to encourage sustainable fisheries via influencing policy makers and fishermen and address the lack of market for sustainable fish, by using positive communication, giving consumers the option and supporting the front runners in sustainable fisheries. Creating a consumer/fish guide provides information that consumers have an option to buy sustainable seafood, helps raise awareness and change companies sourcing policy. The target is to enlarge the market for sustainable seafood products, promote independent certified products (as the preferred option, but also market uncertified products even though they are harder to control), and make change possible to protect the oceans. NSF shares a joint methodology with the Seafood Choices Alliance and can access to a common database between WWF and North Sea Foundation. The NSF help companies and supermarkets to move supplies from red to green listed fish and to move towards supplying and marketing certified sustainable products to customers. Marine Stewardship Council (MSC) is a successful label and Aquaculture Stewardship Council (ASC) has been created recently. GSSI has been set up (an initiative to benchmark the sustainability labels). Examples of green sustainability status aquaculture producers are those who use organic feed, limit use of medicines and treat effluents before discharging to water bodies. If effluent treatment is not enough, we need WFD to set limits on aquaculture production where eutrophication is a problem in water bodies.

NGO's warn that there are limits to growth and encourage the EU not to 'boost 'til it bursts'. We need to measure consumer demand and room for growth accurately and inform NGO's. Key NGO

requirements for the WFD are 1) that data gaps need addressing, 2) seek independent views on the effect of aquaculture on the environmental parameters and discuss the results with NGO's, 3) assess environmental Implications (EIA, SEA) 4) encourage aquaculture practices which minimise negative environmental impacts e.g. encourage sustainable sourcing of feed (AEC/ASC to encourage industry to use sustainable sources to their feed) 5) Adopt technical standards for aquaculture facilities 6) Develop multi-trophic aquaculture 7) Use public funds to support public goods but not to support the expansions of non sustainable goods/negative environmental impacts 8) Promote environmental and sustainable trade at global level, proven with a certified label. We all need to cooperate together to inform consumer with clear message.

Questions

Q. The European commission is issuing sustainable guidelines, what is your opinion on spatial planning and administrative burden.

A. The administrative burden could go down and sustainable aquaculture should address environmental issues.

Q. Why are consumer guidelines green for both trout and carp?

A. All pond carp in Europe is green as the consumer only sees three categories: red, yellow and green. Sourcing policy guides for supermarkets have 5 different colours to differentiate between organically raised carp versus non-organically raised carp. It is appreciated that producers without labels are accepted into the consumer guides as it is still possible to carry out sustainable actions to produce fish, but not have the labels.

Q. Small fish farmers are not really classed as 'industry' as they are often thinking and working differently and may also have other jobs on the side of producing fish.

A. The group voice should be named as 'producers' instead of 'industry'.

Q. Is the trend and demand for sustainable fish products growing?

A. Unknown. Don't know what supermarkets will demand. Don't know if growth of the demand will be in the change from red to orange products or orange to green products or towards more certified labelled products.

Q. Having a good connection between the consumer and supermarket means there is a demand for high quality products in Europe but it is the farmer who pays for this not the supermarket or the consumer.

A. The cost to farmers is beyond the NGO's control but the message to consumers should be to support producers with the most sustainable options and not to buy uncertified fish from non-EU producers but to buy from Europe. NSF can create a market for sustainable product but for the farmers to be paid well for that product is beyond scope of the work of the NSF.

Q. In the UK supermarkets often demand fish fed on fish meal and fish oil only and alternative ingredients are not accepted. What do you suggest to supermarkets?

A. We would not recommend that producers cut out the fish meal and fish oil as this would reduce the welfare component for the fish which need a particular level of fish meal/oil to be healthy. High Omega 3 levels in fish are desirable to supermarkets and consumers therefore NSF can't change that; however the sourcing of that fish oil and meal should be more sustainable. As it is expensive component producers are already trying to reduce the amount of this used in feed. NGO cannot speak on the amount of fish oil/meal, but more on sustainability of that meal/oil.

Speaker 6: Ralf Reinartz, Danube Sturgeon Task Force (DSTF).

"Aquaculture and conservation breeding, conflict or concurrence? the Danube sturgeon example"

The DSTF is an initiative not an NGO which is set up to protect Danube sturgeon with members from varied backgrounds including science, NGO and government. The implementation of the Danube Action Plan was slow or not happening so the DSTF re-grouped the 76 actions into 6 main topics of the programme "Sturgeon 2020". DSTF is open to all as a grouping and interface for communication with those outside the sturgeon world. Open to all who work or want to work for the conservation of Danube sturgeons. DSTF aims to conserve biodiversity of the Danube sturgeon (5 different species) due to their high scientific value and flagship species status. The presence of sturgeon is an excellent indicator of habitat quality and connectivity to WFD. DSTF proposes and fosters in-situ conservation (on site in the river) and ex-situ conservation (in captivity and aquaculture). In-situ delivers the concepts and feedback for adjustment of ex-situ conservation. A sturgeon ranching programme in the USSR released thousands of sturgeons but the population did not recover and stocks decreased further. However, ex-situ aquaculture saved the European Atlantic sturgeon (*Acipenser sturio*) from extinction. In the Danube 1 sturgeon species is already extinct and 5 species remain. The species are all different but are treated as group specific to the Danube basin. Different stocks spawn in different areas and always return to specific spawning sites in river Danube. Some

Danube Sturgeon species need special husbandry conditions and it is difficult to create a brood-stock of certain species. Hybridization with alien sturgeon species poses a potential threat to native populations as has already been proven for the Siberian sturgeon and native sterlet in the Aschach impoundment. Sturgeons are ecologically and economically valuable but are a delicate species to handle. As they migrate across borders it is difficult to coordinate conservation and requires long-term commitment to establish gene banks and create near natural enclosures to mimic the wild and allow wild brood-stock to adjust to captivity. Captive populations therefore have to resemble wild populations and propagation procedures deliver offspring with increased natural survival fitness rather than being adapted to captive hatchery conditions. Aquaculture for the production of sturgeons for release and conservation purposes should be state operated and controlled and seen as a shared international nature resource. Future demands for sturgeon aquaculture should distinguish between sturgeon destined for ex-situ conservation and those for food farming. Sturgeon strains for human consumption should be adapted to aquaculture conditions, whereas for sustainable development of ex-situ aquaculture for conservation there is need for genetically suitable breeding plans and by developing a release strategy. For sustainable development of sturgeon farming for consumption the aquaculture strategy will involve domestication and selection, improvement of rearing conditions, increased preventative methods to avoid escapement and minimizing disease transfer.

Questions

Q. Are sturgeon stocks at threat from predation, particularly by cormorants, and how does it affect the Danube? Does anyone monitor the release of small sturgeons?

A. DSTF has not seen any scientific studies, but in personal opinion (Ralf Reinartz) predators may be an issue for the small sterlet which upon release often swim at the surface. General opinion is that re-stocking sturgeon does not help stocks recover as the sites suitable for sturgeon reproduction have been lost.

Q. Could artificial structures be used to protect young from cormorants? As this is a successful method used in catch and release fisheries to keep bony fish in a protected environment for long enough for them to recover from being caught. There is also a possibility that sturgeon for release to the wild could be put in sub-surface cages until they acclimatise before releasing them. A. Strategies need developing to protect ex-situ young sturgeon from predators while they acclimatise to the wild.

Q. Impact of pollution on sturgeon – what is role of WFD – particularly sediments? A. Sturgeons are susceptible to pollution but unknown in Danube. There is an issue with siltation during spawning period.

Q. Sturgeon is a clear example of aquaculture helping ensure the survival of endangered species. We preserve the native species of sturgeon however due to the changed environment it is worth considering that a new sturgeon species may now be better suited for Danube. Also how is the relationship with sturgeon and CITES?

A. DSTF does not speak on trade agreements. We need hatchery techniques to save the Danube sturgeon species, although there is room for improvement for methods of release into the wild. We do not cross sub-populations from different spawning sites as it may be detrimental for fitness of individuals.

Q. What are the main predators of small sturgeon?

A. Other fishes e.g. gobies, cyprinids like barbel, other sturgeons; even insects can prey on small sturgeon. Larger sturgeon are naturally protected from predation after developing to a certain age or size when they physically cannot or are less likely to be taken by predators.

Speaker 7: Irene Lucius (WWF, Danube and Carpathian areas)

"Maintaining wetland ecosystem services through responsible aquaculture practices"

Economic incentives offer payment for benefits/services that ecosystems provide for humans. Calculated values of ecosystem benefits to be reflected in the price of marketable products e.g. FSC or carbon capture from forests. Application to aquaculture– well managed ponds can increase water quality (nutrient retention capacity) and contributes to biodiversity. Good Practice Example: Ciocanesti fish farm in Romania is a Natura 2000 site and a large nature reserve where the fish ponds act as feeding, nesting and resting area for rare birds. 50% of fish production is eaten by protected and other bird species. There is a risk in Romania that fish farm owners will want to reduce their pond area due to pressures from bird predation, disturb birds using gun simulators or add nets to prevent birds feeding on fish which will adversely affect the bird populations using the fish ponds as wetland habitat. The long term solution for fish pond owners is to ensure long term sustainability via business diversification (e.g. ecotourism) and from mobilising public funds which are tailored to incentivise wetland ecosystem services. Romania offers annual one off payments and grants for tourism products. Aquaculture has to comply with compulsory legislation; however Romania offers compensation for voluntary activities beyond requirements e.g. reduction of grain feed, water

quality sampling and monitoring, measuring the reed bed area, maintaining reed beds, flooding of unused/uncovered basin/ponds for populating with non-commercial species. Costs of up to 60,000 euro per year are available to carry out all these ecosystem service activities.

Questions

Q. Who pays the compensation?

A. The Department of Fisheries in Romania, this is a new pilot study. There are a lot of expected outputs. To earn the compensation the producer needs a whole range of targeted measures to be implemented.

Comment: The amount of compensation is not calculated by loss of yield, only partly in some measures. Calculations on loss of biomass are required.

Q. Consider the market distortion effect; to subsidise aquaculture activity means fish may then be sold for a lower price which may cause market distortion. Birds also adapt to circumstances e.g. egrets and grey herons take advantage of methods taken against other species like adapting to gas guns used against cormorant.

A. No market distortion is expected as the production of the fish is not less expensive – the compensation is only paying for losses and costs of labour to implement these effects.

Q. For a single problem the compensation approach is a good solution. However fish farmers want to keep producing fish as a profession rather than put aside land for environmental services when they cannot get the fish ponds back in production again.

A. We are not suggesting all fish farmers take the ecosystem services approach, but only particularly important fish farms as each pond is considered to have a different value for nature. They may uptake these approaches voluntarily. The ecosystem services approach encourages diversification of aquaculture business e.g. attracts bird lovers and tourists and alternative income. 80% of Danube flood plains have been lost and there have been attempts to restore only a fraction of those lost, therefore the attention has turned to the ecosystem benefits of fish pond habitats.

Summary of the Day

There is a need to integrate aquaculture into other activities that are happening. We have heard examples of innovation from sturgeon and trout farmers that often simple solutions can be effective and double production easily. Key challenges for producers are the use of water and predation. The

challenge for conservation is meeting long term goals across large areas. MS need to share and work collectively to take forward economic and social impacts to also benefit environment. There is a need to have open networks and joint ventures for communication to gain mutual benefits and shared equity. Money should be used to fund improvements or generate value – create clear market, diversification or payment for ecosystem services.

Day 2: Wednesday 21st May

Session 3 Good practice examples: effective and cost-efficient transposition and implementation of the WFD and MSFD for aquaculture

Speaker 8: Key Note Speaker Tamas Bardocz (Ministry of Rural Development, Hungary)

“Developing a national aquaculture strategy in line with the WFD and River Basin Management Plans”

EU aquaculture is very diverse from marine cage culture to intensive inland freshwater fish farming tanks and ponds. In the Hungarian example: policy makers deal with objectives of WFD and a National Aquaculture Strategy and European Maritime and Fisheries Fund (EMFF). WFD’s general broad objectives are not in serious conflict with aquaculture. For the required RBMP’s the Danube river basin is so large that 4 sub-basin management plans are required to list specific problems and actions. These will be reviewed and revised RBMP’s produced for the next phase of WFD. A National Aquaculture Strategy is an obligatory document that needs producing to unlock access to EU funds. The main goal of this document is to define how to use the 2 main tools of national legislation and both EMFF and national funds for aquaculture development, and then to publish the strategy. Hungary currently has 26,000 ha of fish ponds with mainly traditional carp production (20,000 tonnes of fish including 16,000 tonnes of carp) and also intensive production of African catfish. Water from intensive aquaculture then passes into extensive ponds for cleaning of the water. Small wintering ponds can be used for pond recirculation system – large pond serves as treatment pond for intensive production and as a habitat for nature.

The Aquaculture Development Strategy for Hungary includes: 1) Improvement in feed conversion enabling more efficient fish production 2) Using more efficient types of production systems to improve sustainability and reduce environmental impacts 3) Encouraging producers to ‘borrow water’ and return it to the river instead of use and remove it.

Actions to develop aquaculture following guidelines from the commission of how to develop an aquaculture Strategy including: 1) simplification of administration (easy to say but main problems

Background information for sustainable aquaculture development, addressing environmental protection in particular

from European levels directives) therefore try to refine guidelines e.g. easier for farms to get water in winter to encourage water retention. Aqua-envir measures to give clear rules to farmers 2) Simplified licensing process for integrated systems (currently takes only 5-6 months to process but still room for improvement) that should distinguish between intensive, extensive and combined farm technologies 3) enhance competitiveness: - improve attractiveness of market for carp e.g. new law to introduce fish onto school menu once a week (pilot project) 4) new national law for freshwater fishery and angling – reduce poaching of fish from rivers and lakes- reduce black fish market 5) research new technologies for Horizon 2020 programmes 6) Spatial planning (EU union suggestion) e.g. undertaken GIS map and database of unused existing geothermal wells and surface waters (incl. fish ponds)7) Promote aquaculture as a side project for large investment e.g. use geothermal effluents and reuse wasted heat for aquaculture 8) use results from WFD monitoring to decide where aquaculture can develop 9) Develop a level playing field 10) promote EU sustainable fish e.g. carp, a Hungarian producers association could be created 11) encourage labelling and certification to distinguish different aquaculture types. The impacts of following this strategy include: production of more fish, higher environmental values, an increased market/demand, and diversification of activities. Hungarian aquaculture production could be increased by up to 8000 tonnes if this is carried out.

Questions

Q. What certification should producers aim for?

A. Environmentally friendly products e.g. carp produced in extensive system is not as good as organic but better for the environment than other types of production e.g. cage farming. Need to create a European wide label to recognise this.

Comment: Work with WWF standards for this.

Q. Enhancing competitiveness in Germany did not work it only encouraged sourcing from abroad.

A. This competitiveness needs to be carefully managed by marketing plans of producer organisations and by the state. It needs to be written into plans and be realistic.

Speaker 9: Catalin Platon, Executive Director, ROMFISH, National Association of Fish Producers.

"Aquaculture part of the problem or part of the solution?"

In Romania Aquaculture is possible almost everywhere as there is 140,000km³ of water bodies (rivers, natural and artificial lakes, ponds and pools) of which 17. % is used for agriculture and only 0.42% is used for aquaculture. Artificial lakes are used for flood prevention and power production.

10,000 tonnes of fish including Cyprinids, trout and other species are produced annually by aquaculture in Romania, from 40000 hectares of ponds and pools (leased), and 15000 hectares of dam lakes and reservoirs (state owned) and 34000 hectares of ponds (owned by local communities in Danube Delta). Aquaculture in Romanian reservoirs only use natural feed and yields 100-200kg of fish per hectare. Multipurpose lakes are used for leisure, agriculture, hydro-electrical power and fish farming. In large lakes aquaculture in cages (trout, carp and sturgeon) is used. The Romanian producers do not pay rent to lake owners but they are paying the water volumes transited during the production year, including evaporation and infiltration. In pond farms the farmers are paying a lease for the land and the water intake (including losses due to evaporation and infiltration). Ponds farming is the most common way to produce market size fish using local inputs of cereal for food and local workforce labour. Pool aquaculture on rivers/streams, where water is held in a dam and stock fish are grown for consumption, involves the producer paying to retain the water (including the losses caused by evaporation) and pay costs to ensure the safety of the dam. Pond farming produces higher yields of 500-1200kg of fish per hectare.

The problem with WFD and aquaculture is article 9 concerning water services and the principle of recovery of costs, with incentives and environmental objectives to meet and the polluter pays principle to uphold. Water services concerns abstraction and impoundment e.g. as necessary by aquaculture however the only loss of water from the system is via evaporation therefore the water is not 'consumed' like agricultural practices. There are also no incentives for returning water to the river cleaner than it entered the fish farm. Conclusions from the first phase WFD report is that in Romania fish farms do not adversely affect the characterisation of surface waters under WFD and there are lots of fish farms which are designated Ramsar and/or Natura 2000 sites (or potential candidate sites). In terms of Natura 2000 Directives, restrictions on birds or other animals protection (especially fish eating ones) are applicable inside or outside Natura 2000 sites. The benefits of fish farming are that it has local inputs, short chain from producer to consumers, offers low-trophic farmed species, can be used to produce multi-trophic species and water filtration services by common carp or aquatic plant control by herbivorous grass carp. Aquaculture should follow the ecosystem approach to ensure ecological wellbeing through semi-intensive farms (which also offer rural employment and development of areas) and using sustainable management strategies e.g. use of natural feed supplemented with cereals. Aquaculture ponds can have beneficial effects on biodiversity and also act as a buffer for droughts and floods. Potential issues to expanding aquaculture in Romania include the possibility for Chinese carps to escape to the wild (but there is not enough data or evidence of this occurring to regulate this) and conflict with local environmental

NGO's as Grass carp is a competitor with birds/ducks for food therefore aquaculture of this species needs discussing with public and NGO's. There can be conflict and user/access rights to water for aquaculture and producers often lack formal aquaculture training/skills. Human wellbeing is intrinsically linked with social and environmental values.

Governance issues can include a lack of political will to strategically expand aquaculture, poor communication and a lack of technical knowledge/intersectoral skills/infrastructure. Conclusions: Aquaculture/Fish farming needs protecting in central and eastern Europe. Taking an ecosystem approach to WFD and Natura 2000 directives, fish farming must be considered as part of the solution, research needs supporting, regulations need to be made specific, and there is a need to involve fish farmers in consultations and dissemination.

Questions

Q. What do you think about producers having more contact with local association rather than just top level associations?

A. Local NGO's are likely to be more emotionally involved, and European level associations are generally more scientifically based. Reports from local associations are often statements and not science/knowledge.

Comment: Producers are guided by direct experience and they need to transfer their knowledge to local NGO and governance.

Comment: Communication at local level is key; this can be explored in the breakout groups later.

Speaker 10: Dr. Violin St. Raykov (IO BAS, Department "Marine biology and ecology" EWG Black Sea, STECF, EC, Vice Chair WG Black Sea, GFCM)

"Aquaculture in the Black Sea: management, environmental implications and sustainability"

Black Sea countries e.g. Russia, Turkey, Bulgaria, Ukraine, Georgia, Romania have a total aquaculture production of approximately 5 million tonnes which is dominated by production from Turkey and Russia. Rainbow trout, common carp and silver carp are the most common finfish aquaculture species and there is also some mussel culture in Bulgaria. Permissions are issued by 4 different administrations who require the provision of data to issue licences to producers e.g. on Farm Dalboka the ecological effects of mussel cultivation are measured in the benthos directly under the farm, 100m and 500m away from farm. Species composition is found to be highest 100m from farm and community diversity index is highest under farm. Total abundance includes those organisms attached to mussels and equipment (often crustaceans, polychaetes and oligochaetes). The mussel

ropes also act as a spawning and nursery area for fish. Turkey fish farms source wild brood stock for fish and larvae rearing. Restocking activities have involved capture/recapture of turbot and sturgeon and are showing positive results from the restocking activities. Worms used for bait have a large market value in the Black Sea region.

The Advisory Group on the Environmental Aspects of the Management of Fisheries and other Marine Living Resources priority is to enhance development of sustainable marine aquaculture including dissemination of guidelines for aquaculture for restocking activities, use of ICZM, GIS environmental monitoring programme, undertake EIA, and consider allowable zone of effects and the use of indicators for sustainable aquaculture. AZA (Allocated Zone for Aquaculture) process has evident differences between countries and is constrained by a lack of clear legislation and poor cooperation between stakeholders when it needs proper coordination and development plans to be successful. Conclusions from a database built with support from GFCM (General Fisheries Commission for the Mediterranean) were that there is a limited number of species that are currently or can be aquacultured so to expand aquaculture in the Black Sea region diversification is needed and therefore different technology will require development and implementation. Restocking activities should concern restocking of natives only, use best aquaculture knowledge supported by research, monitoring of fingerlings survival, breed pathogen free fish, implement tagging and recapture monitoring programme, and involve cooperation among different institutions across countries in the Black Sea region.

Questions

Q. Does SIPAM involve all bordering countries of Black Sea?

A. Only 3 countries are obligated: Bulgaria, Romania and Turkey. However, other countries may volunteer info.

Speaker 11: Ferenc Levai (FEAP)

'Creating Frameworks of Good Practice'

Ferenc explained that good practice terminology needs to be correctly defined. Good practice is fully effective performance of documented operating procedures. Good practice includes clear evidence-based definition of objectives and achievable outcomes, well designed proportionate, properly transposed and enforced legislation, fully adopted industry codes of good practice and approaches; professional management and a trained skilled workforce and evidence-based decisions. Good practice requires regulators to avoid one size fits all legislation and avoid transposition that is difficult to adopt (understanding is needed). Research and Development is

essential to provide an evidence base relevant to aquaculture in practice, in order to develop workable solutions to challenges for the aquaculture industry. Codes of good practice need updating regularly to reflect technology and new legislation. Effective stakeholder communication is critical for enabling compliance with operating procedures. Legislative and regulatory burdens make it difficult to get new aquaculture sites approved, and are time-consuming and costly. FEAP wide perceptions are that widespread problems stem from multi-agency – multi-legislation, bureaucratic systems, inconsistencies in systems and costs, lack of parity with other users and a poor level of understanding of aquaculture. This burden can be disproportionate when compared to farming, forestry and other types of industry. There can be a negative burden of WFD on pond farmers with the cost borne by farmers for monitoring and them ending up being treated as a polluter where negative results lead to fines (e.g. high suspended solids can be exclusively mineral solids therefore do not contribute to eutrophic waters) however positive results (water ending up cleaner leaving the farm than entering) are not being rewarded.

Examples of good practice are the catchment and river basin management (UK), Freshwater Environmental Impact Unit Charging (EIUC) England, Water extractions and pollution systems (Poland), Restocking & maintaining biodiversity by the preservation of ponds and wetlands (Italy, Portugal, Hungary). As an example of good practice the pond farmers perception is that pond farming provides a completely unique use of aquatic resources.

Water is retained and discharged it is a purifier not a polluter 98% of organic matter is utilized inside the pond system, suspended solids are mostly mineral particles. The ecological benefits of pond aquaculture are well documented in increased biodiversity and preservation of important wetland habitats.

Questions

Q.Are there problems in aquaculture ponds with cyanobacteria/blue-green algae blooms in summer?

A. No, if production is controlled correctly then that is not a problem and producers can use lime even in organic production.

Comment: Good practices are a good initiative for aquaculture but not all production types are the same – there are different good practices for different types of producers. It is preferential to have a recognised label or proper legislation.

Q. Sustainable aquaculture is complicated and can often face problems with national NGO's due to lack of knowledge from NGO's whose knee jerk reaction is that they don't want development. Difficult for NGO's to build knowledge without involvement with local projects – specifically to build aquaculture knowledge.

A. There is need to improve communication between local NGO's and fish producers to enable developments of sustainable aquaculture as per the Hungarian example (Ramsar area, Natura 2000) clear transparent operation enables discussion and cooperation. Projects are technical and require previous knowledge of aquaculture so the local NGO's may not understand. Request local NGO's to employ people with prior knowledge or training or learn from producers directly on the farm.

Comment: It is good to know that NGO's all have different ways of making money- some are fund raising via alarming and extremism to get publicity, or they can subsidise money to inform their opinions via working with industry to build up expertise and knowledge. You cannot just hire expertise and not work with producers.

Q. Why should fish farmers pay to educate NGO's?

A. Aquaculture is a multi stakeholder process. Producers don't have to subsidise NGO's but just involve them, as producers don't get subsidised for projects, they just produce the fish. Research institutions are more likely to subsidise research projects which could involve NGO's.

Q. Self-governance is a positive sector tool. Stakeholder involvement requires participation of environmental NGO's and consumer organisations. It is often difficult to get attendance from environmental NGO's and consumer associations because of lack of manpower to attend/time. Often NGO's only have 1 person involved in food policy and especially aquaculture therefore they are difficult to involve.

Speed presentations

3 minute – 1-2 slide power-points presentations on MS approaches to transposition and implementation of WFD and MSFD

Otilia Mihail (Counsellor at Ministry of Environment and Climate Changes, Department on Water, Forest and Fisheries, Romania) Transposition and Implementation of Water Framework Directive and Marine Strategy Framework Directive in Romania

Transposition of the WFD is via the Water Law 107/1996 with further modifications and amendments (the water law includes the provision of the flood directive). The legislation addresses aquaculture as 5% of specific measures cover aquaculture fields. In Romania aquaculture activities are monitored and reported according to the legislation. Romania is in process to develop the second River Basin Management Plan according to the requirements of Water Framework Directive. The Contracting Parties of ICPDR decided as Secretariat of ICPDR to be the coordinator of the implementation of Water Framework Directive to have a common understanding of implementation process. MSFD was transposed in Romania by emergency government ordinance 71/2010 and adopted by law 6/2011 and amended by law 205/2013. Implementation of the MSFD includes an initial assessment report submitted (as per article 8) determination of GES-MSFD (as per article 9) environmental targets have been set up (as per article 10) and national reporting is carried out. Now RO has started to update the national programme of monitoring according to the directive. From July to August is scheduled the public consultation.

Break out Groups

Discussion of what constitutes good practice for effective and cost-efficient transposition and implementation of the WFD and MSFD.

Summary of break-out groups discussion – conclusions from session 2



Veinna - Break out 2
- Raw - Good practice

Comment: FEAP thanked Cefas for facilitating the workshop.

Close of the main workshop

Annex 5: Minutes of the Baltic Regional Workshop (Copenhagen)

Minutes: Good Practice Workshop on Sustainable Aquaculture (Baltic Region)

12th-13th June 2014, Ministry of Foreign Affairs of Denmark, Copenhagen.

Day One: Thursday 12th June

The workshop was opened by Michel Schilling (Director of Danish EPA) who welcomed delegates and introduced the need for guidance under WFD and MSFD. He mentioned the move of Danish trout production to model farms and land based salmon farms where the use of recirculation systems increased fish production while decreasing environmental impact. He hoped the workshop would provide a forum to share best practice.

Darrio Dubolino (DG MARE) then welcomed the delegates and highlighted the commissions view on the importance of aquaculture in food production and the need for good environmental protection. He mentioned the extended time to obtain a license for aquaculture operation in many MS and questioned whether this was enhancing environmental protection or was a reflection of imperfect administration.

Neil Auchterlonie (Cefas) then introduced the project and the aims of the workshop and thanked the Danish EPA for joint funding of the workshop.

Q: How many staff are involved in this project?

A: We have had around 14-15 staff deployed on various parts of the project up to this time.

Presentation 1: (Keynote Speaker) Jouni Velma, Aquabest Coordinator, Finnish Game and Fisheries Research Institute: Lessons from the “Aquabest “ project for the development of a sustainable aquaculture industry in the Baltic region that meets environmental obligations.

The project sought to define examples of best practice in the Baltic and look at the role of initiatives and incentives to put these into practice. The project recognised that well intentioned “red tape” could lead to stagnation of food production. The project came up with a series of practical recommendations in areas of regulation, spatial planning, nutrient budgets and recirculation systems (RAS). Key recommendations were the need for a level playing field for all food production, the importance of stakeholder engagement, use of mussel culture as a nitrogen sink and better use of unwanted Baltic fish species.

Q: Dilution is not the best solution to eutrophication issues in the Baltic so moving aquaculture offshore will not represent a solution.

A: Well, as aquaculture contributes <1% of nutrient levels in the Baltic with the rest coming from other sources this could be linked to nutrient to nutrient trading schemes. We need an integrated approach.

Q: Have you considered the economic viability of pen systems in the Baltic?

A: They complement existing salmon and rainbow trout production and the sector needs more than one species to remain viable.

Presentation 2: Anu-Maria Sandelin (Finnish Fish Farmers Association): Presentation on the Federation of European Aquaculture Producers (FEAP) perspective.

There is a need for increased aquaculture production whilst reducing the administrative burden, accessing space and water, increasing competitiveness and explaining the advantages of fish consumption. There are many challenges in the regulations and we need a more flexible, risk based approach with relevant environmental studies and research. At present the legislation is not well adapted to the practical issues of constantly evolving new systems and technologies to be compatible. Without some change there was a limited future because of WFD constraints.

Presentation 3: Brian Thomsen (Danish Aquaculture Organisation): The perspective of the Danish Producers

Overall, the future involves looking at emission based regulations and marine zoning. Denmark has a national integrated aquaculture industry integrating feed, processing and production with good relations with regulators. Aquaculture is more than fish farming and the forecast is for growth of €1.5B and 1,800 new jobs. The main issues are: (1) ensure neutral nitrogen emissions by reducing total nitrogen discharge; (2) ensure sufficient space for growth; (3) benefit from R&D. Any changes must involve consultation with stakeholders to bring everyone along together. Future developments will involve RAS (where emission based regulations are needed), marine RAS (where there are big capital investments), and moving to zones outside WFD. The regulations need to move from “command and control” to incentive based systems.

Q: You talked of WFD but did not mention MSFD – does this reflect the relative importance of the two legislative drivers?

A: Most challenging is the WFD, with MSFD having more limited impact.

Q: WFD has a one nautical mile jurisdiction for good environmental status whilst MSFD has 12 nautical mile jurisdiction for good chemical status.

Q: Is there any progress with monitoring methods which would be needed for an emission based regulation?

A: For many years the Danish industry has used an established method of 26 annual samples, comparing inputs with outputs, with the results feeding into a model.

Presentation 4: Jesper Heldbo, Aquacircle: Recirculated Land Based Aquaculture

The reduction in water consumption from a traditional pond system to an intensive recirculation system is from 40-50,000l per kg produced to 40-500l per kg produced. This compares to 15,500l per kg for beef and 4,800l per kg for pork. In RAS, there is a need to control biosecurity by having all entry via a disinfection room. Faecal material is removed by filters, and this material can then be used as fertiliser. For effective RAS there is a need for a reliable power supply with backup and highly skilled staff for monitoring 24/7. The expense may be offset by rearing only using RAS for early growth stages.

Q: Is it possible to have organic certification with RAS?

A: It is not possible under present EU legislation.

Q: Are there plans to publicise the CO₂ footprint for RAS produced product?

A: There has been a report issued containing this data.

Presentation 5: Per Dolmer, Baltic Blue Growth Partnership : Mussel production as a mitigation to extract nutrients from finfish farming.

the presentation covered multi trophic levels of aquaculture and the management of integrated systems as mitigation for nutrient release. Mussels will only remove particles (2-5um) and therefore only remove c. 12% of the nitrogen. Adjacent seaweed culture can remove soluble nutrients from finfish farming. The seaweed and mussel farms do not need to be close to the fish farm. There is a low impact on the sea bed of such mussel and fish production. There is a significant improvement in water quality from the use of such systems including a dramatic increase in water transparency. The mussels create "reefs" which attract other organisms and thus increase biodiversity. There remain challenges with production / harvest and predation. A system is needed for payment to cover such a wide ecosystem approach where different elements are spatially separated. To close the nutrient loop we need to find methods of processing the small mussels into feed.

Q: Is this economically viable for the production of mussels as food?

A: Mussel growth varies by region but is potentially viable if consumers pay an increased cost.

Q: The use in fish meal would need direct interaction with the producing farms?

A: Farmers can use the biomass where the mussels are too small for human consumption. It would need a holistic management system.

Lunch

The afternoon session commenced with a short discussion on WFD & MSFD, and their relative importance to aquaculture.

Q: Maybe WFD is more prevalent in producers thoughts because it is the older legislation compared to MSFD?

A: MSFD is not at the catchment level but at the region level and MSFD defaults to other directives if they exist.

Speed presentation Session:

Julia Overton : Aquapri

The company is involved in trout production, trout roe, and pikeperch, of which 90% is for the export market. They have a vertically integrated system for production through to market and this supports local employment. Best practice in Denmark is regulated and industry has to put in place measures to improve the environmental footprint. Water treatment and recirculation are priority areas – the latter is expensive and overall the sector needs a mixture of traditional and new recirculation systems to be financially viable.

Florian Mühlbauer, University of Rostock: Environmentally friendly net cage production.

Dr Mühlbauer described a system in Germany that is a single point mooring and has been in existence for 30 years producing up to 40T annually with no benthic impact. The cage is moved to distribute the nutrient load and there is periodic fallowing of the site. The parasite pressure is very low so very low exchange with wild fish. Use triploid rainbow trout which have little impact on the indigenous sea trout. No chemicals or antibiotics are used. Low production leads to low impact but get €18/kg in the market for the product.

Q: you mentioned that one parasite was identified in the system. What was the parasite detected?

A: *Brachyphallus crenatus*

Ole Schmidt, Aller Aqua A/S: Improved environmental performance as seen from the feed producer.

Aller Aqua is a second-tier feed producer. The retailers have their own standards which the feed producers are asked to meet for their production. There is a trend to decreasing fish oil in the feed. There are a variety of smaller private standards leading to a decrease in fish meal and fish oil content and an increase in vegetable ingredients. Aller Aqua are looking at incorporation of seaweed products in feeds. Feed producers need to listen to farmers on ways that feed affects production

and environmental impact e.g. some feeds affect faecal stability which can caused problems in RAS.

We need a holistic view across the food chain.

Q: How long before new feeds might arrive on the market?

A: This is work in progress

Q: Are you also using mussels in your feed?

A: Yes, these are in trials now.

Q: Are you thinking of using insects in your feed?

A: Possibly.

Torben Wallach (Musholm A/S): Marine finfish systems

Musholm are working on marine rainbow trout aquaculture. The production has been severely affected by the winter storms emphasising the need to weather proof marine cages. Musholm is also working on net cage systems.

Breakout Group 1: Discussion of what constitutes good practice for ensuring better environmental performance across all types of aquaculture in the context of the WFD and MSFD

Summary of Breakout group findings.



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Afternoon Presentations:

Presentation 6: Marco Frederiksen, EUROFISH: 6 lessons from AQUAFIMA project

Aquafima is integrating aquaculture and capture fisheries in the Baltic having a multi tiered approach to revisiting fisheries policy, research into capture and aquaculture production and promotion of production.

Q: You mentioned restocking – do you see drawbacks as well as benefits from this?

A: There are different views in different countries and is not clearly positive or negative.

Presentation 7: Gianluca Fiore (Joint Research Centre): Aquaculture farming: between environmental impact and the need for development

Dr. Fiore reviewed a number of aspects from spatial distribution of aquaculture sites, seafood market and trade, coastal communities, and LCAs for aquaculture. The need to increase aquaculture

production is clear from FAO figures. Risks from aquaculture development include impact on the environment but this is a new industry and aquaculture is subject to more stringent controls than are applied to pork or beef production for instance. It is important to have a holistic approach to production. It is important to have a holistic approach towards production, identifying aquaculture as one of the possible methods to increase protein production to feed an increasing world population..

Q: What does an ecosystem based approach for aquaculture mean?

A: Cannot expect aquaculture to be the only production system in a given area – requires coordination from those different activities (i.e. ecosystem services) in the region.

Q: Is it possible to calculate the saving if EU does not import 65% of its seafood?

A: This needs to be calculated; however, the key issue is the (almost) full dependency of the EU on imports in this sector. This is particularly relevant as we consider the development of a wealthy middle class in the exporting countries, with the consequent risk that national production (now destined to export) may be diverted to national consumption.

Q: Who will pay for a system which reduces registration time as will require more staff?

A: An improved system does not necessarily require more staff and therefore may not increase costs. EU Member states must find more efficient methods and better coordination between different administrations, with the target to reduce both time and costs. In a recent round of visits to EU member states it has been observed a lack of lack of harmonization of the relevant EU legislation, both between countries and between areas of the same country.

The comment was made that there was evidence of poor systems and uncoordinated approach. The comment was also made that VMD (Veterinary Medicines Directorate) in the UK had a time based approach for the authorisation of medicines. In that system, if the application is poor it requires more staff time for evaluation, and thus increases the costs, which are passed onto the applicant.

The discussion continued with the point that delays in licensing can mean the loss of confidence from investors, resulting in the loss of financing for the applicant and therefore the loss of the farm development. The suggestion was made as to an online “click system” to allow easy compliance of completeness of an application. The point was also made that a long time to obtain a license can also mean that by the time the license is obtained, the technology has become obsolete and needs to be updated. This can lead to appeals which then extend the time to obtain a license.

Q: Is it the EU’s intention to reduce the time to obtain a license?

A: The EU would not specify a decrease in the time to obtain a permit as a goal, but we can see this is an area where considerable improvements can be made e.g. having a “one stop shop” for

registration to reduce the time up to six months, as reported in the EU Commission Communication concerning the “Strategic Guidelines for the sustainable development of EU aquaculture

Q: What does an ecosystem based approach for aquaculture mean?

Presentation 8: Nils Hoglund (Coalition Clean Baltic): Baltic sustainable aquaculture – how do we get there?

The aquaculture sector must face facts and realities. There are no new feeds (as discussed at this workshop) for the next 5-10 years so we are left with feeds continuing to contain 40% fish content and this is not sustainable. We are still mainly talking about advances in open cage systems but they remain open cage systems. Wide spread compensation for nitrogen and phosphorus with mussels and seaweed is still not feasible and there is a real risk of anoxic areas in the Baltic as the present compensatory measures seem insufficient. We need to ensure a mass balance of nitrogen and phosphorus for the Baltic. There are also disease risks and insufficient control of fish movements within the EU. Even when issues are addressed, the level of employment given by aquaculture will still be limited and this will be niche markets for fish production. A consortium of NGOs (CCB) has issued a joint statement that all production should move to RAS systems and sustainable feeds still need to be achieved.

Q: Labelling of the provenance from fisheries is improving ...are the anoxic areas associated with climate change?

A: They do not seem to be related to climate change – more to agricultural input.

Comment: With W. Baltic mussel production need large areas and small mussels produced mussel production may not be commercially viable at present.

Comment: Fundamentally, we need methods to increase production so we can feed people.

Presentation 9: Ann Dom (Seas at Risk): Priorities for environmentally responsible aquaculture in the EU

The organisation “Seas at risk” focuses on EU policy and recognises the advances that aquaculture has made, and its importance in producing food. Consumers are becoming better informed but there remain concerns about production. Growth is not infinite and we cannot continue to expand production - we should consider making better use of available food and eliminate the waste and look at alternative protein sources (e.g. insects). A science-based approach with a precautionary principle is recommended and it was noted that there is still no EU report showing the sustainability of aquaculture. We need to avoid irreversible effects and the depletion of non renewable resources. An ecosystem approach should be adopted, where the polluter pays, taking account of feed

sustainability, disease, staff training, the impact of chemicals. There may be advantages in moving to a common EU production and labelling system with effective monitoring. There is no accepted definition of “sustainable aquaculture”.

Q: Sustainable aquaculture based on ecologic principles can be laid down in environmental legislation and is this being worked on?

A: The EU has many areas of legislation but these are not necessarily implemented effectively.

Q: Other sources of protein- must not forget the potential of using smaller unwanted fish

A: Insect use was quoted by the FAO and the need to explore other options for feed.

Neil Auchterlonie then summed up and closed the first day of the workshop.

Day 2

Presentation 10: Keynote Day 2: Marco Milardi (HELCOM Secretariat): HELCOM recommendations for sustainable aquaculture development in the Baltic Sea, with special reference to Implementation of WFD and MSFD and other environmental regulations.

The Baltic Sea encompasses 9 coastal states. Chemical contamination extends across the sea not just in coastal regions. Activities of all states affect the sea’s environment, and 4% of species and 27% of biotypes are in danger of extinction. Non native species may also be having an impact.

Anoxic areas caused by eutrophication are increasing. Overall, however, nitrogen and phosphorus loads have decreased by 18% and 16%, respectively, between 1994 and 2010.

HELCOM uses a holistic assessment incorporating other assessments from different programmes.

The Helsinki convention (which sets up HELCOM) Annex III specifically mentions best practice in aquaculture as a mean of preventing and eliminating pollution. There are a number of measures implemented to reduce discharges from fish farms. It is a diverse environment – not only physically, but with different socio- economic environments and different markets. The new recommendation drafting process incorporates non native species, ecologic and genetic impact of unintended release, WFD, MSFD. The plan is to look at a variety of aspects to achieve sustainable aquaculture.

Q: The Helsinki agreement states elimination of pollution from land and fish farming- is this achievable?

A: This was written some time ago when perhaps the feasibility of a complete elimination had not been accurately assessed

Q: The reduction in pollution from land sources – what if this is not technically feasible? Can we apply alternative methods of e.g. charging?

A: Local agreements can be made with the use of alternative approaches to meet the reduction targets.

Q: When will the review be complete and the recommendation published?

A: The recommendation should be examined by the end of the year and subsequently published if approved.

Presentation 11: Rosita Brostrom (presenting on behalf of Åland Islands Government): Åland Island Experiences

Åland is an archipelago in the Baltic composed of 6700 islands of which only 60 are inhabited. It is a self-governing autonomous region of Finland where employment (although small in numbers) is vital for the local economy. Production of mainly rainbow trout is 5,100,000 kg, at €25m and employs c. 75 people with a big local impact. Better cage construction has allowed movement to the outer archipelago and there has been a decrease in nitrogen and phosphorus associated with increases in farm size but a decrease in the number of farms. Economic and administrative stability was needed with a balanced view from all MS.

Under WFD the status is moderate which means that the local environment has to improve. Fish farming is the main source of phosphorus in Åland, but for the Baltic even if fish farming stopped this would not change the WFD assessment. We are looking at closing the loop for phosphorus effluents but need guidelines on what is a Baltic raw material and guidelines on practical use. There has to be an integrated approach across all MSs using the Baltic as an example. There are a number of local initiatives to address these issues in Åland. The problems are common and their solution is only achieved through cooperation.

Presentation 12: Malin Skog (Swedish Board of Agriculture): Swedish Aquaculture.

Production is 12,500t fish, 1300t mussels and 1000t for restocking. Main production is rainbow trout with some arctic char in fresh water, and 3000t production in the Baltic.

Production is through caged aquaculture and 5 water agencies have responsibility for WFD plans. Nutrient discharge into the Baltic is a concern. There is only one functional RAS system and there may be potential for mussel production but the Swedish market is small and the economics are difficult.

Q: what is the species produced in RAS?

A: Eel (93 tonnes)

Presentation 13: .Anders Vedel (Danish Ministry of the Environment): The Danish regulatory approach to develop sustainable trout farming - using mussels and seaweed to compensate for discharged nutrients N and P.

There are 23 marine rainbow trout sites in Denmark, producing 10,500t. Approval requires the participation of 4 administrative bodies.

The test case described was for a farm in Endelave comprising one trout farm, 3 mussel farms and 1 seaweed farm. The nutrients are incorporated in the phytoplankton which is then taken up by mussels so the mussels do not need to be adjacent to the fish farm. The trout farm covers 24ha, mussels 56ha and seaweed 100ha. The trout production is 2105t, mussels is 7,500t and seaweed 700t. It is regarded as sustainable and compensates 115% N and 70% P. All production is organic. Challenges are: (1) the local management plan does not allow additional nitrogen emission; (2) the special needs are great; (3) production is uncertain; (4) stakeholder engagement. The local plan requires a decrease of 30t N and conditions for compensation are: (a) compensation needs to be in same water as the fish farm; (b) mussels and seaweed must be harvested and removed; (c) N and P need to be tested on harvesting; (d) N and P need to be assessed before and after growing season; (e) the process must be transparent to the regulators; (f) trout production can be reduced or stopped if the compensation is insufficient. Such a system requires a comprehensive approach across the region.

Q: How are the mussels and seaweed to be used?

A: The use is not at present clear. We are looking at mussels for fish feed as well as human consumption. Seaweed is being used for animal feed and high value products.

Comment: The UK is seeing some interest in exploiting seaweed production for biofuels, energy production and other higher value uses.

Comment: Interested in how to use the residual sludge after biofuel extraction, as the remainder is too high in cadmium for use as fertiliser.

Q: has the impact of the mussel farm been evaluated?

A: Not yet - this is the responsibility of a separate project.

Comment: Mussels and seaweed are expensive and there are issues for mussel production with predators. Use of mussels for fish feed is expensive as a process is required to shuck the mussels.

Still looking for uses for seaweed production

Q: Has the impact of rainbow trout on sea trout breeding been evaluated?

A: I am not aware of any documented impact.

Q: You mentioned that there were some general concerns from locals - can you expand as to who this was?

A: This came from summer house owners and fishermen.

Comment: There is no published impact of escaped rainbow trout on sea trout.

Comment: Although you mentioned that mussels compensate by 115% the real compensation figure is probably much higher.

Q: Compensation needs to be in the same water body but the source of the N and P in the phytoplankton cannot be known - does this matter?

A: The compensation is viewed on a regional basis rather than there being a direct link.

Q: How can we increase compensation for phosphorus?

A: Phosphorus compensation is sufficient in this specific case but cannot be used as a generalised compensation mechanism.

Presentation 14: Eduard Koitmaa (Ministry of Agriculture, Estonia): Estonian Aquaculture

120 people employed in Estonia aquaculture rearing rainbow trout, carp and sturgeon, eel, arctic char, catfish, crayfish all in FW farm systems.

Rearing is for both human consumption and restocking. Crayfish farms rear noble crayfish (400kg pa). There are 29 aquaculture production units producing 730t per annum. Production is increasing and 10 RAS systems are in operation. The Strategy for 2020 is seeking to grow production to 4500T for local consumption and export.

Q: Your RAS systems, are they fully recirculation?

A: Yes

Q: Why is there a difference between the potential production and actual production?

A: The gap reflects new systems getting on line.

Speed presentations

Igor Wawryniak: Approaches to WFD and MSFD in Poland

There are 55,000 Ha of fish ponds, dam reservoirs and other waters, rivers and streams. Annual production is 50,000t produced of sturgeon, crayfish, pike perch and cyprinids. Poland has a variety of environments from marine to brackish water to fresh water and pond farming. Rainbow trout are reared in traditional pond systems and extensive farming.

In Poland there is a strong tradition of pond farming going back for over a century. The ponds are constructed on poor agricultural land - the ponds are used for fish production but also irrigation, reservoirs and flood control. The depth of the ponds can be varied depending on the type of production and stage of the fish. There is a number of different habitats within the pond system

which enhances biodiversity. The ponds retain the nutrients, phosphorus, nitrogen and solids, and so helps to clean the water. Pond cultivation has many advantages in the culture of fish.

Q: What happens in winter?

A: The fish are removed and ponds are fallowed although the production cycle is 3 years.

Q: Do you have ponds downstream from trout farms?

A: They can compensate for trout farms but ponds are not always located downstream.

Q: This looks labour intensive system so I would imagine that they employ a number of people?

A: The whole sector employs approximately 5000, probably half are employed in pond production.

Q: Is this system exportable to other Baltic countries?

A: It is somewhat constrained by temperature and water supply.

Inese Mikelsons: Aquaculture in Latvia

Aquaculture in Latvia consists of only FW systems with a small production used for human consumption, restocking and commercial angling. There are 145 aquaculture companies, 39% of production being for human consumption, 32% for restocking and 29% for both restocking and consumption. 82% of systems are ponds, 10% are basins with 8% RAS. Most of the pond systems rear cyprinids whose value is €1.1m (carp, sturgeon, pike perch, catfish, crayfish). The sector employed 250 people in 2013.

Q: Is the burden in establishing new farms due to environmental constraints or economics?

A: It is not difficult to obtain licenses in Latvia as the companies are mainly small.

Anu- Maria Sandelin: Finland aquaculture

The sector in Finland generates €34m but 84% of consumption is imported (mainly from Norway). Finland produces 10% from fish farming and 6% from fisheries. Small production units (60t) dominate the sector, and there is a heavy administrative burden. There have been no new farms licensed and production is stagnating. Difficulties are predators such as seals, long winters, and ice cover. It is difficult to compete with Norwegian production.

License renewal is treated like a new license so very intensive and can take 2 years to be granted.

Permits last for 6.6- 9,7 years and the cost is €14,620. Environmental surveillance is 3% of the cost of production. Finnish fish farmers are very skilled and well educated. There are 10 RAS systems and a large farm using aquaponics.

Q: How long has the aquaponics unit been running?

A: About 2 years- has evolved.

Q: Is 3% of the cost really for environmental surveillance?

A: Finland requires more frequent environmental surveillance.

Comment: Marine litter and its relevance to MSFD has not been discussed at this workshop, but we should recognise that this is an important aspect of MSFD. It should be included in the project because the aquaculture industry may be a contributor to litter.

Breakout Group 2: “Discussion of what constitutes good practice for effective and cost-efficient transposition and implementation of the WFD and MSFD.”

Summaries from breakout groups.



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Neil Auchterlonie summed up the workshop, described next steps in the project, thanked delegates for their participation and input, thanked the presenters for the presentations, and thanked the Danish Ministry of the Environment, and the EPA for sharing the costs and providing the venue.

Nils Christensen, Head of Division, Industry and Agriculture at the Danish EPA closed the workshop by noting the complexity and diversity that had been discussed over the past 2 days, and that we could all learn from each other in addressing our common issues.

Annex 6: Synopsis of Administrators Questionnaires

A summary of the results of the survey of National Administrations for issues relating to the implementation of WFD and MSFD in MSs.

The information presented was gathered from two approaches: 1) A questionnaire, comprised of 10 individual targeted questions relating to aquaculture and environmental regulation, sent to all national administrations across EU-28 (and some EEA states); 2) Each regional workshop held a session for administrators to discuss issues relating to implementing the environmental legislation. The questionnaire provided responses from only 12 states, and there was one additional written response from a MS. The administrators' sessions at the regional workshop largely represented those MSs in the specific region, and thus the focus was on issues relating to those geographic locations. The results are presented below in summary:

Questionnaire:

Q1: Are there areas around implementation of WFD and/or MSFD for aquaculture where you see a need for guidance for the national/regional administrators responsible for implementing these Directives, and if so what?

A1: Responses were provided in 11 out of 12 questionnaires returned. Of those 11, 3 indicated that guidance was not required in those MSs, due to guidance already being present, or not applicable (e.g. where the industry is formed of land-based RAS predominantly). Two of the 3 MSs that had suggested that guidance was not required, however, raised the importance of the issue of setting a microbial standard for shellfish under the WFD. For the 8 MS who agreed that guidance would be of benefit the following points were raised:

- Fish farming in ponds should be regarded as an activity that is undertaken in artificial water bodies;
- Guidance is required especially in relation to aquaculture impacts and MSFD descriptors;
- Guidance is needed to enable aquaculture development in locations where no additional nutrient input is allowable;
- Guidance on the application of Council Regulation (EC) No 708/2007 of 11 June 2007 concerning use of alien and locally absent species in aquaculture would be of value;
- A common interpretation and standardisation of approach is important, but conversely there is no "one-size-fits-all" due to the nature of the diversity of aquaculture systems.

Q2: What are the areas around implementation of WFD and/or MSFD for aquaculture where you see a need for guidance for the Industry & NGOs?

A2: Of the 12 responses, 2 registered no need for guidance for industry and NGOs, one of which already had guidance in place for aquaculture development, water quality objectives and emission guidelines. Of the remaining 10 that considered guidance necessary, the following points were made:

- There is a need to address the descriptors for MSFD in relation to coastal and offshore aquaculture; this is also true for WFD;
- Guidance on (a) common approach to be made across Europe in relation to factors such as:
 - water flow;
 - standards for permitted discharges (chemical, and physical e.g. temperature);
 - physical impacts of aquaculture developments on water courses;
 - risks of stock escapes;
- Industry specific guidance could usefully promote awareness of the requirements and appropriate behaviour/actions to support WFD and MSFD aims;
- Descriptions of good practice and Best Available Technology (BAT) would be useful;
- Information and guidance on hazardous substances, threats of pharmaceuticals used, their effects and role in aquaculture is needed;
- Application of a scientific approach – modelling, monitoring etc., and the application of a mixing zone or footprint.

Q3: How have the administrators engaged with the public over the implementation of WFD and MSFD for aquaculture?

A3: This question was answered by 11 out of the 12 respondents. Engagement with the public was reported at different levels such as:

- Public consultation for both WFD and MSFD;
- Public consultation through the RBMPs and engagement with local stakeholders;
- Public engagement on the initial assessment for MSFD, development of GES-MSFD, targets and indicators;
- Discussion with stakeholders about the specifics of aquaculture impacts (and the fact that some aquaculture may have a positive rather than a negative effect – some fish farms don't have to pay taxes);

- Aquaculture not reported as relevant as a separate subject in one MS, but covered in more general discussions about pressures relating to WFD and MSFD;
- Aquaculture not reported as being specifically addressed in the Program of Measures or RBMPs by one respondent, although a large aquaculture industry is present (with a reason presented that specific details of aquaculture impacts and how to manage them are still being worked through);
- One respondent reported public consultation on licence applications, and public reporting of (some environmental) performance data for aquaculture businesses.

Q4: Is sustainable aquaculture addressed within regional RBMPs? If so, what proportion of the plans includes aquaculture?

A4: This question was answered by all 12 respondents, with only 5 reporting the specific inclusion of aquaculture in RBMPs. In relation to the proportion of the plans relating to aquaculture, or the pressures identified within RBMPs resulting from aquaculture, only 2 respondents answered this question, referring to <2% and c.5% overall.

Q5: Following the repeal of the Shellfish Water Directive, what measures are in place in your Member State to ensure a comparable water quality in shellfish areas?

A5: This question was left unanswered by 2 respondents, and a further 3 respondents identified the question as not relevant (no shellfish industry in those states). For the 7 respondents that answered this question, the following points were made:

- Primary legislation is currently being prepared;
- WFD provides comparable or better water quality for the mandatory requirements of the Shellfish Waters Directive. The only outstanding issue is the microbial standard for public health purposes. We are using national legislation to insert this into WFD as a national protected areas standard;
- The regional water authorities appoint areas to protect economical valuable aquatic species. The local authority in is about to establish and adopt a program of measures for mussel waters.

Q6: In the context of the implementation of the WFD and MSFD, how are nutrients addressed in your national legislation and practices in relation to aquaculture?

A6: This question was answered by all but one of the respondents. Points were made regarding the assessment of aquaculture nutrient impacts as follows:

- Nutrients are assessed specifically in national aquaculture regulations;
- Nutrients are addressed in the licensing stage by using carrying capacity models to estimate biomass limits (2 MS);
- Nutrients are addressed under MSFD Programme of Measures, which is aligned in national legislation directly with nutrient levels under WFD;
- Nutrient monitoring is carried out under WFD, UWWTD, and Nitrates Directive.
- For inland (fresh) waters offline fish farms (where water is abstracted from a river or lake, put through the farm and then discharges back to the river/lake) are controlled by a permit system that regulates levels of potential pollutants (including P) in the discharge to the river/lake, in order to meet the WFD standards in the receiving waters.
- Discharges of N and P in effluent are regulated to achieve WFD standards;
- No specific requirements for aquaculture. Discharge standards apply for effluents discharged to surface waters. However, land-based aquaculture is usually carried out in closed fish farms; effluents are being discharged into sewer and treated in urban waste water treatment plants;
- The nutrients are incorporated as environmental quality standards. All authorities and municipalities are responsible for ensuring that standards are followed.

Q7: In the context of the implementation of the WFD and MSFD, how are chemical impacts addressed in your national legislation and practices in relation to aquaculture?

A7: All respondents answered this question, but a variety of approaches is apparent across the national authorities, such as:

- Chemical impacts are addressed in national aquaculture regulations;
- EQS are set in national legislation;
- Undertake OSPAR contaminant monitoring in shellfish – no standards but Ecological Assessment Criteria (EAC) assessment for the OSPAR Quality Sector reports;
- Rules implementing the OSPAR Recommendation 94/6 on Best Environmental Practice (BEP) for the Reduction of Inputs of Potentially Toxic Chemicals from Aquaculture Use;
- It is not addressed;
- Addressed in national regulation transposing the Dangerous Substances Directive (76/464/EEC, 2006/11/EC);
- Addressed in the national programme for the granting of aquaculture licences;
- Medicine use in aquaculture is not monitored;

- A system of authorisations is supported by monitoring;
- The chemical impacts are incorporated through environmental quality standards.

Q8: In the context of the implementation of the WFD and MSFD, how are escapees and other interactions with wild fish addressed in your national legislation and practices in relation to aquaculture?

A8: This question was answered by all 12 respondents. Three respondents reported that this is not an issue, due to the nature of the aquaculture industry in that country (species farmed, or production system type e.g. RAS). One respondent stated that this is a subject that is not addressed. For the other 8 respondents the following points were made:

- Addressed under Regulation (EC) No 708/2007 concerning use of alien species and locally absent species in aquaculture;
- In the national Marine Strategy (MSFD) there is an environmental target under descriptor 2: “Efforts are being made to reduce the transport of non-indigenous species via fishery and aquaculture activities”;
- Conditions set in permits for operation to require screens to stop egress and ingress of fish. Deliberate stocking of fish into inland waters from aquaculture sites (and other sources) is subject to a consents process which takes into account the impact of fish introductions on native fish stocks and the aquatic environment. This system pre-dates WFD but helps support its objectives;
- National standards for aquaculture equipment help to manage the risk of accidental release of aquaculture animals;
- National permitting scheme for release of fish into waters.

Q9: In the context of the implementation of the WFD and MSFD, how are physical impacts, predator controls and disturbance addressed in your national legislation and practices in relation to aquaculture?

A9: There were 3 nil responses, and one response stating that this is not addressed at all. For the 8 respondents the following points were made:

- These aspects are addressed at the local (provincial level) in fisheries, hunting, or nature protection legislation;
- Addressed in national legislation covering planning consents, or wildlife;
- Addressed in aquaculture licence conditions that specify predator control measures;

- Aquaculture facilities are specifically mentioned in GES for Descriptor 7 of MSFD on Hydrographic Conditions;
- Collection of mussel seed is subject to licensing, in which among others physical impacts and disturbances are addressed. The authority issues guidance to industry so as to monitor and assess the effects on water quality. There is no predator control;
- Disturbance is addressed in national licensing scheme and there are provisions in national legislation to take measures against predators. Bird-netting is widely used to exclude avian predators in the first instance. There are no significant problems with sea-mammals;
- There is a minimum 1km distance between 2 fish farms. Fish farms use nets against birds and dolphins.

Q10: In your experience, what aspects of the implementation of the WFD and MSFD are the most problematic in relation to aquaculture, (e.g. in terms of uncertainties, administrative burdens, conflict between different stakeholder groups, diverging interpretations etc.)?

A10: All but one of the 12 respondents answered the last question, with the main points raised summarised as follows:

- The importance of water flow, and conflicts of existing aquaculture ponds with the requirement of achieving good ecological status/potential according to WFD;
- Conflict with conservation requirements, and the concept of setting environmental quality standards for artificial water bodies;
- Nutrient enrichment issues;
- For WFD implementation the lack of an EU legal driver for shellfish microbial standards leaves implementation challenges on how to consider it in line with the WFD regime;
- Administrative burden, related to permitting, control measures, etc;
- Implementing the measures to reduce nutrient loads and agreeing on appropriate share to be devoted on aquaculture;
- Technological aspects, on what is environmental-friendly technology, what sort of measures to implement, who should pay for that;
- Decision support systems for the siting of aquaculture installations that address socio-economics, optimisation of the site based on hydrographical conditions that produce the optimum yield and best practice on management and husbandry need to be produced to ensure that the industry and policy/regulation have a clear understanding of the framework around regulation and licensing. This should be framed in the context of monitoring and measures that are required under both WFD and MSFD to achieve GES;

- Different government Departments deal with environmental legislation and regulation (responsible for implementation of WFD and MSFD), and Aquaculture licensing;
- In relation to MSFD – only a very small area of less than 1% of the designated waters is affected by aquaculture;
- Insufficient methodology, lack of common interpretation of the legislation and national guidance on the regional level and disagreements on roles (“who-does-what”);
- Development of policy in relation to sea louse medicines;
- There is a national goal of no eutrophication (WFD + MSFD) as well as commitments within Helcom BSAP, which almost puts a total stop to nutrient emissions that may reach the Baltic Sea. This may make it difficult for companies that make applications for new or extended fish culture permits. The burden of evidence that there is little or no negative effect is on the aquaculture company. In some cases it is not clear which data the companies should provide to show the baseline nutrient load. There are uncertainties about the levels of nutrients (if any) that reach the Baltic from inland fish aquaculture in lakes and rivers that reach the Baltic Sea;
- Very few people here at stakeholder levels is aware of WFD and MSFD. We need more information concerning aquaculture aspect.

Summary of additional points that were not covered in the responses to the Questionnaire, but were raised during the regional workshop sessions for administrators:

- There is a lack of sufficient time series in the data for the aquaculture industry that would feed in to the WFD PoMs;
- It is best to achieve a regionalised approach to guidance on non-native species. Specific issues and guidance may be different for different regions.
- We need to address the issue of provision of licences for *C. gigas* cultivation. Objections which are being returned to applicants are related to feral *C. gigas* populations, and this is a barrier to expansion of sector. Obligatory use of triploid shellfish would negate this issue;
- Sea bed litter – how do we manage this in relation to aquaculture? Do we use SCUBA divers to remove litter as there is no other available technology?
- Issue of marine litter – easy aim for public and politicians to create measures and industry have been engaged – plastics and cosmetics sector to discuss solutions prior to the regulations;
- *Crepidula fornicata*: Guidance would be incomplete without reference to threats to aquaculture such as the slipper limpet.
- Climate change – invasive species may close down aquaculture area unnecessarily, as climate change may change species boundaries/limits anyway. The mackerel fishery moved further

north earlier in the life cycle than has happened before. Caution regarding being too prescriptive;

- Differentiate between monitoring to assess water body vs. monitoring to assess impact from different sources. How do we quantify and understand pressures – how to measure and describe. Near field and far field impacts depend on the water body.
 - Use a table to present data for different types of aquaculture as diff types of indicators are used to identify significance of impacts. Link WFD, MSFD and Habitats directive. Make the information easy to reference;
 - With respect to spatial planning, there has never been clear guidance on how this should be implemented. There is a replication in the sampling that is required. The system needs to be made more streamlined so that data that is collected can be used. There also needs to be more consistency across how the WFD is implemented in different member states.
 - If there are no allowable increases in N&P discharges, how can aquaculture develop in the Baltic? Can we use compensatory aquaculture to neutralise emissions? The drivers for this should be developed nationally, as well as through Directives;
- There is a recent report to the Nordic Council of Ministers on BAT (Best Available Technology) in aquaculture; Although in Norwegian, the text does contain a 60 page English summary; the text covers research advances in the area and could be useful to the project;
- WFD requires the removal of barriers in river catchments to be undertaken; This is an issue from a biosecurity perspective as new areas of some catchments are being opened up to wild migratory salmonids, potentially carrying pathogens in to those areas;
- The responsibility for managing any compensatory measures – if this is an approach that is worth taking – should be carried out at all levels – local, regional, and Baltic Sea;
- A key point noted was the need for help for Local Authorities and Municipalities to respond to the MSFD:
 - Planning for open waters as compared to coastal waters;
 - Dealing with the visual impact of mussel and seaweed farms;
 - Cover industry guidance on meeting the various descriptors.

Annex 7: Feedback from Regional Workshops (Breakout Session 1)

Below is a summary of the findings from Breakout Session 1, of the four regional seas workshops (Dublin 10 - 11th April 2014, Athens 5 - 6th May 2014, Vienna 20 - 21st May 2014, Copenhagen 12 - 13th June 2014).

“What constitutes good practice for ensuring better environmental performance across all types of aquaculture in the context of WFD & MSFD?”

A qualitative analysis was undertaken on the information received in discussion during the breakout groups by the project team at the regional workshops. Comments received at all the four workshops were reviewed, and grouped according to a *post hoc* defined subject area. Scores for each of the subject areas were produced (Fig. Annex 7.1) and a text synopsis produced for each subject area.

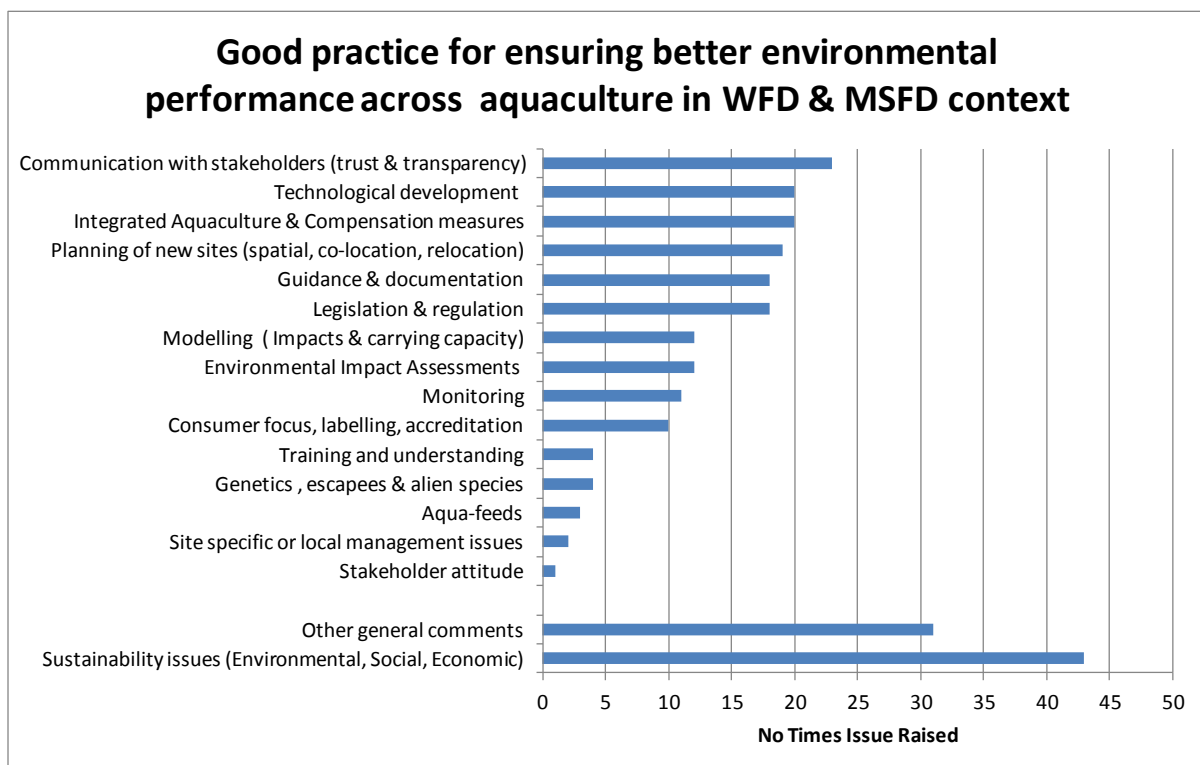


Fig. Annex 7.1: Scores for subject areas discussed in relation to the question “What constitutes good practice for ensuring better environmental performance across all types of aquaculture in the context of WFD & MSFD?”

Synopsis of comments received

Communication with stakeholders (trust and transparency): Communication with stakeholders is important in terms of building trust and transparency. Effective consultation, outreaching and inclusion of all stakeholders leads towards improved sustainability. Release of information and communication between administrators and data holders helps develop trust. Sharing of good practice leads to improved environmental performance. Communication should be clear and provided in native languages whenever possible.

Technological development: Further development of new technology such as feeding and farm management systems can help reduce the level of impacts. RAS may play an important role but the commercial viability and competitiveness of these systems were questioned and concerns were about technical requirements and issues around disease.

Integrated aquaculture and compensation measures: Integrated aquaculture such as IMTA or aquaponics is seen as having potential to improve environmental performance across aquaculture sectors. Much research, data and sharing of good practices are needed to inform future practices in this area. The nutrient extractive nature of shellfish and seaweed culture may be able to mitigate against potential inputs of N and P.

Planning of new sites (spatial, co-location, relocation): Site selection and location of certain types of aquaculture play an important role in reducing environmental impacts. Spatial planning for aquaculture and integration in RBMPs and MSPs will help achieve aims of WFD and MSFD and deliver space for producers. Integration of aquaculture with other sectors might be an option.

Guidance and documentation: Provision of (regularly updated) guidance documents that help administrators and producers know the requirements for aquaculture would be beneficial. Definitions are needed at a pan-regional level for MSFD and its 11 descriptors. Guidelines should provide for different aquaculture sectors indicating the impact, the measures and the mitigation. Guidelines are required at both a local and regional level.

Legislation and regulation: Greater consistency in interpretation, enforcement and compliance with legislation will help achieve the aims of the environmental legislation. Legislation should be responsive, proportionate to risk and minimise regulatory burden on the producers.

Modelling of impacts and carrying capacity: The use of modelling tools helps to implement an ecosystem approach ensuring that aquaculture impacts can be managed within the system, important habitats are protected and that the carrying capacity is not exceeded.

Environmental Impact Assessments: EIA is already in place and is often stringent. Inconsistency in application needs to be addressed and a fully holistic approach be developed.

Monitoring: Effective monitoring and control of emissions are necessary but this requires clarification and standardisation of parameters to be monitored across sectors and the industry as a whole.

Consumer focus, labelling, accreditation: Labelling and accreditation schemes offer potential consumer choice over the environmental standards of production systems. However, it was questioned whether price overrides labelling and if the producer or the retailer gains. Producers need to benefit from meeting standards whether in the EU or elsewhere.

Training and understanding: Understanding of aquaculture systems, impacts, mitigation and sustainable practices should be developed for training and education at many levels from schoolchildren through to administrators.

Genetics, escapees and alien species: Aquaculture species destined for human consumption need to be separated from stocks that are destined for restocking the wild. Alien species need to be regulated and monitored according to legislation.

Aqua-feeds: Feed quality and its management are important in reducing environmental impact. Consideration should be given to local production of aqua-feeds.

Site specific or local management issues: Local management practices such as operating all –in / all-out year classes with fallowing regimes can provide environmental benefits.

Stakeholder attitude: There needs to be a willingness at all levels of the supply chain and at political levels to improve practices.

Sustainability issues (environmental, social and economic): Comments varied within this section.

- Good practice for environmental performance cannot be separated from social and economic performance. Operational scale may affect good practice.
- An understanding of the laws of nature is important and that sustainability operates over a longer timeframe.
- There is recognition that whilst aquaculture is not the biggest source of nutrient input this must still be managed somehow.
- Producers should operate within the terms of their licence.
- Medicine and treatment usage should be minimised and as prescribed by veterinarians.
- Tax incentives for environmentally friendly aquaculture systems could provide incentives.

Other general comments

- Aquaculture strategies should be in line with MSFD and WFD objectives.
- Positive impacts should be recognised.
- Many producers are already using best practices.
- There is no one-size-fits all approach and best practices need to be specific to the type of aquaculture.
- Better availability and cataloguing of data and use of GIS mapping will contribute to improved environmental performance.

Annex 8: Feedback from Regional Workshops (Breakout Session 2)

Findings from Breakout Session 2 of the regional workshops (Dublin 10 - 11th April 2014, Athens 5 - 6th May 2014, Vienna 20 - 21st May 2014, Copenhagen 12 - 13th June 2014) are summarised below.

“What constitutes good practice for effective and cost-efficient transposition and implementation of the WFD & MSFD?”

A qualitative analysis was undertaken by the project team on the information received in discussions. Comments received at all the four workshops were reviewed and grouped according to a *post hoc* defined subject area. Scores for each of the subject areas were produced, and are presented (Fig. Annex 8.1) with a descriptive synopsis produced for each subject area.

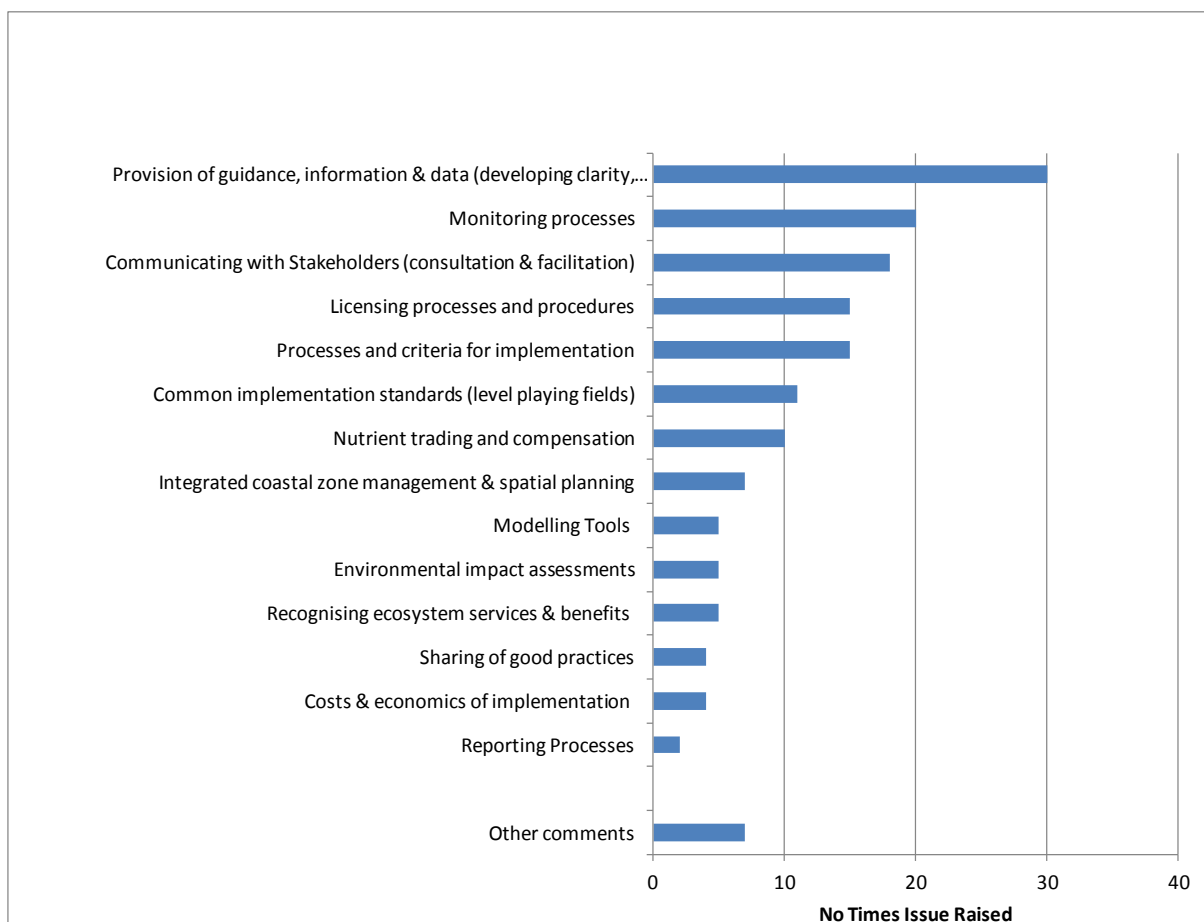


Figure Annex 8.1: Responses to question: “What constitutes good practice for effective and cost-efficient transposition and implementation of the WFD & MSFD?”

Synopsis of comments received

Provision of guidance, information & data (developing clarity, understanding & openness):

Provision of clear guidance on WFD & MSFD and other environmental legislation and how they relate to aquaculture is essential. This guidance should provide a common understanding and interpretation of Articles and Directives and provide clarity on what is required leading to a more coherent approach. However, where required the guidance should allow for regional or national needs in relation to implementation without providing barriers to trade or excessive regulatory burdens. Guidance should address the issues that are contentious and causing confusion. To build trust and confidence, data and information from regulators on aquaculture performance should be transparent and readily available for stakeholders. Knowledge and understanding of aquaculture technology needs to be developed within stakeholder groups including regulators.

Monitoring processes: Standardised methodologies and appropriate monitoring of similar aquaculture systems would be beneficial. There is a need to agree EQS for different regions and species. This may require further scientific research and the adoption of risk based monitoring approaches. Such an approach should build on EU project work and work with other MS and European countries as well as organisations such as ICES. Baseline information is required so that possible effects can be monitored, including at large scales (but taking into account the relative contributions of aquaculture against those of other industries) and should consider the broader picture of what else is happening in the water body.

Communicating with stakeholders (consultation and facilitation): Time should be taken to allow for open consultation across all stakeholders and users. Local communities and authorities should be included. Clarity and understanding is required across boundaries and between ministries. Feedback and review mechanisms should be clear and continual. Translations into local languages must be available. Adaptive strategies and conflict resolution procedures should be considered, and the appropriate amount of time should be taken for consultation.

Licensing processes and procedures: The licensing application should be processed swiftly without undue delay and the conditions should deliver the requirements of WFD and MSFD. The duration for licence applications to be processed should be standardised across EU28. One-stop-shops have been proposed as a means of supporting these aims. Harmonisation of licensing across Member States and sectors would be beneficial. Systems in place need to ensure that the standards applied to currently operating sites are updated to be the same as those applying for new licences when

existing licences are renewed. Approaches taken should account for any local variations that may be present under certain conditions. Appeal systems should be available when either applying for, or renewing, licences. The inclusion of aquaculture in RBMPs may be helpful.

Processes and criteria for implementation: Implementation processes should draw from experiences in other fields, e.g. hydropower, and the concept of proportionality needs to be followed. Care should be taken to provide balanced, practical, feasible, simple and streamlined regulations that target the issues concerned without duplicating other regulations.

Common implementation standards (level playing fields): The common implementation of Directives helps provide a level playing field across MS. The implementation should be consistent across different sectors for the same issue e.g. nutrient loads so that some sectors are not disadvantaged. The standardisation of the approach is key. Efforts should be targeted where conflict exists between Directives and to areas of contention such as the application of minimum flow criteria.

Nutrient trading and compensation: This issue was discussed at length in Copenhagen, where there was a real focus on the topic in relation to the Baltic Sea – see sections 8.1.2 and 8.1.3 and Annex 5. Compensation methods and nutrient trading schemes should be considered as a permitting option by regulators in areas where good ecological status is compromised or threatened. Further research is required within this area. Technological solutions are likely to become available to help reduce input of N and P.

Integrated coastal zone management and spatial planning: Integrated coastal zone management and spatial planning that incorporate aquaculture and its impacts will help deliver WFD and MSFD objectives and sustainable industry growth. Allocation and sharing of space with other industries are important issues. The marine planning process is important in affording the industry the opportunity to grow.

Modelling tools: The use of approved validated scientific modelling systems based on good baseline data can identify likely impacts and position sites with reduced impacts accordingly. Acceptance and recognition of these models across the EU needs to be achieved. The use of the near field and far-field concept is an option. Models should be validated and improved over time, in order to provide more accurate predictions of impacts.

Environmental Impact Assessments: EIAs should be used to inform decisions before permission is given. The scale of the EIA needs to be appropriate with the size of the operation. Common approaches and standards are needed for EIAs across Member States for equivalent types of aquaculture.

Recognising ecosystem services and benefits: The ecosystem services and benefits provided by some types of aquaculture should be recognised when implementing WFD and MSFD. Workshop contributions highlighted mutual benefits between environmental regulations and the aquaculture industry. For example, sustainable finfish farming can offer environmental services (water quality and purification effects, phosphorous and nitrogen retention), water management and water retention services (e.g. irrigation and flood control, wetland habitats, increased biodiversity) appropriate to WFD objectives. There may also be broader environmental (and social and economic) benefits of some aquaculture systems.

Sharing of good practices: The sharing of good practice and implementation of voluntary schemes such as codes of good practice are cost efficient and effective mechanisms for implementation of WFD and MSFD objectives.

Costs and economics of implementation: The economics and costs of implementing new Directives should be considered and made transparent from administrative levels to producers.

Reporting processes: Reporting requirements should be proportionate, feasible and risk based.

Other comments included: algal toxins and sources should be considered; labelling and benchmarking are important drivers giving consumers choice.

Annex 9: Minutes of the Second Brussels Workshop, 29th September 2014

Project: Background Information for Sustainable Aquaculture Development, addressing in particular good practice in environmental protection, and implementation and transposition of the WFD and MSFD

Stakeholder Workshop #2: Brussels

Venue: Conference Centre Albert Borschette (CCAB), 36, rue Froissart, B-1040 Brussels

Date: 29th September 2014

Minutes of Meeting:

Welcome and Introduction

Joachim D'Eugenio of DG ENV opened the workshop. Mr D'Eugenio commented that he was pleased with outcome of the project so far, especially the process that included the consultation with many stakeholders through the regional workshops. Mr D'Eugenio followed this by saying that this final workshop builds on the dynamic achieved from regional workshops, and today is the participants' opportunity to have their say on what they like / dislike in the report, including identifying what is needed to finalise the project. Participants also have the opportunity to submit comments in writing after the workshop. The report is an important and comprehensive resource, and DG MARE & ENV will build on this to state their view on aquaculture development and environmental regulation (timing tbc). Thanks were extended to the regional coordinators for facilitating the regional workshops in the project.

Anna Zito followed with comments on behalf of DG MARE, mentioning that the report is one of the commitments from the Commission following the 2013 guidelines. MS were asked to develop Multiannual National Plans (MANPs) outlining their plans for aquaculture development. The Cefas report is an important resource for the Commission to use in drafting guidelines. Anna Zito also informed the meeting that the Commission's follow-up on its Apr. 29 -2013-Communication – including the handling of the answers to the seven questions on administration – was postponed due to the appointment of a new Commissioner. Follow-up will probably take place towards the end of 2014.

Neil Auchterlonie of Cefas summarised the aims of the workshop, and the project process. The draft has been circulated to attendees of all previous workshops (one Brussels, four regional) with

comments invited in response by the deadline of 9th October 2014. There is a list of 23 recommendations in the report, and today's discussion will focus on those as well as examples of good practice in aquaculture regulation (national administrations) and mitigation of aquaculture impacts (industry).

2.1a Chris Vivian: WFD overview in relation to Aquaculture and 2.1b Kieran Hyder: MSFD overview in relation to Aquaculture

Discussion 1

- We need to look at aquaculture from an **ecosystem perspective**, e.g. may / or may not reduce pressure on wild stocks so may / or may not be a positive under MSFD (e.g. how much feed coming from wild stocks?);
- **Long administrative procedures** are a big problem for the industry – EU 2013 guidelines on sustainable aquaculture, what is the outcome from the questionnaire? (NB. outwith Cefas project) DGMARE is collating responses and will report back to help MS & Aquaculture sector simplify things through best practice exchange;
- **Maritime Spatial Planning** – problems / issues with other Directives overlapping, e.g. Habitats Directive covered in the 2012 Natura 2000 guidance document, and to some extent in the Cefas report. How will potential sites meriting protection (e.g. Birdlife International shadow list), but not yet designated, be addressed where there is pressure to develop
- **Commission Guidance**: The Commission will use the Cefas report as a baseline / feeder document to develop guidance on how to implement the WFD and the MSFD in relation to aquaculture. Timeframe for publishing the guidelines will be dependent on the appointment of the new Commissioner.

2.2 Keith Jeffery: Overview of aquaculture in EU28 slides

Discussion 2

- Freshwater aquaculture is reducing but there has been an increase in marine production over the last 10 years with the result that overall levels are static. In the figures presented there is confusion between salmon & salmonids (e.g. Italy greatest producer of trout in Europe) need to make sure figures & context correct;
- Perhaps the report should say more on employment numbers in relation to production (e.g. likely to decrease as facilities become larger and more efficient), however jobs should include the full supply chain from source to consumer not just work directly on sites so there is potential for growth. It was noted that socio-economics points were often raised at the regional workshops, but were essentially outside the scope of the project. It is considered an important subject area, nonetheless.

2.3 Keith Jeffery: Categorisation of environmental pressures / benefits from aquaculture systems

slides

Discussion 3

- Availability of fish meal for aquaculture diets is a problem (ultimately want less pressure on wild stocks for feed), and it is disappointing that feed is not addressed in detail in the project. It was pointed out that the fishmeal/fishoil issue is an indirect pressure in relation to WFD/MSFD and although noted on occasion during the comments was also considered outwith the scope of the project. There is only limited time to address the point now but is something that can be flagged for recommendations for future work. It was pointed out that often retailers specify incorporation levels of fishmeal/fishoil in feed. Fishmeal is a protein commodity – there has been a steady transfer of protein used for land based production to marine (aquaculture) so it is important that this is kept on the agenda. With the feed issue it is important that the International Fishmeal and Fishoil Organisation (IFFO), and the Marine Conservation Society representatives provide their comments;
- Commission stated that it is important that the project report remains focussed on the original Terms of Reference (i.e. too late to ask contractor to work further on it).
- The ecosystem approach is at the core of all EU environmental legislation and there is a need to make sure that report sets out the context of ecosystem based management for aquaculture.
- The Commission is addressing the issue of discards under CFP Reform and changes to the landings obligations may have implications for access to fishmeal. Perhaps this should be mentioned.
- It is good that aquaculture was identified as a sentinel for water quality (i.e. exit water better quality than input);
- Aquaculture is one of few mechanisms / incentives to protect lagoon habitats, and that is an important point that should not be lost;
- The project team was asked for their definition of sustainable aquaculture. Cefas agreed that a definition of this term was lacking in the text, and this would be included in the amended version;
- The pressures section draws attention to the increasing effect of chemical contaminants – the amount of chemicals input into the system from aquaculture from a WFD perspective should not be underestimated (unlikely for MSFD given regional sea scale);
- The dilemma of Natura 2000 sites and aquaculture both looking for ‘pristine’ waters needs further consideration. This is out of scope of Cefas project as it is covered in the Natura 2000 & Aquaculture guidelines.

3.i Keith Jeffery: Good practice examples by industry

Discussion 4

- There are various examples of code(s) of conduct at local & regional levels – should these be EU wide? Answer - must be relevant to the production methods and region so may not be appropriate to scale up to EU level, i.e. must be fit for purpose. CoPs tend to be specific to

an industry/system/region, and the transposition of these over a wider area/industry may not be appropriate;

- Phosphates – there is a case to improve phosphate outputs from industry overall, and how best can this be managed for aquaculture and tied to GES? This aspect needs further discussion in the report.
- Sea lice is an important issue and needs more discussion and clarification of the impacts in the report.
- Cost is very important for industry sustainability, so it is important that sites & processes are managed efficiently.

3.ii Chris Vivian: Good practice examples by administrators and regulators slides

Discussion 5

- Perhaps not enough emphasis on the development of environmental indicators. Norway has developed pressure impacts of escapees on salmon, for example. Norway is requested to provide more information on indicators. NB. Some discussion on indicators is included in an Annex to the report, and that discussion reflects the ToR which was to “liaise with the EEA, ETC, and JRC on the development of indicators for sustainable aquaculture”;
- EU-28 MS provide a high quality of aquaculture product for the market although there is some uncertainty on whether sector can provide the quantity required by the market. In EU28 aquaculture is a luxury product, and 64% seafood is imported;
- Fallowing was questioned with respect to importance as an example of good practice? Does the report recommend fallowing as good practice, there are pros & cons but not applicable in all areas so is an example of good practice for certain areas / scenarios but determination of use will be site specific. Further research needed to bring this more into the spotlight, and it was noted that the application and management of fallowing would be specific to species/system/location.
- The application of the Precautionary Principle was discussed at length with some stakeholders saying that the apparent misuse that has been documented currently looks biased in the report. Comments were made at the workshops but tangible evidence difficult to tease out. FEAP offered some examples of where the PP had restricted aquaculture development;
- The sector has an ‘obligation’ to provide data to national administrations and how this is fed / shared across EU can be improved and inform discussions on environmental impacts and their management;
- Article 4.7 of the WFD was raised as a key point in relation to aquaculture development, and the question was asked as to whether there are any examples of how this applied to aquaculture because it does not seem to be included in the recommendations. In response the project team mentioned that there had been no examples of the application of Article 4.7. uncovered during the project, but its use in administration was included within the recommendations within more generic wording. That wording would be made more specific in the amended text;

- It was asked whether a database of good practice could potentially be developed as a follow-on project? In response, it was pointed out that a large amount of information had been collected through the regional workshops, and it may be possible to provide this as a separate resource other than the current location on the CIRCA website;
- Has the project identified differences in interpretations in autonomous regions compared to MS? Yes, that was the case.
- Within the overview of potential environmental pressures there appeared to be less emphasis than could perhaps be applied. Some of these are well documented so some sections may be able to apply 'stronger' arguments / statements.

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4. & 5. Neil Auchterlonie: Summary of Project Report Recommendations

Comments were invited on whether it was a good idea, and how to prioritise the recommendations noting that at this stage only the project team could really do this, and it would be entirely subjective. The project team agreed to incorporate a priority rating, but this would include caveats as to its acceptability. Agreement that some form of prioritisation will be very beneficial – all the presentations and feedback from the workshops has been documented. As a general point, it was noted that the evidence base behind the various recommendations needs to be more explicitly stated, and so the text needs to be expanded.

4.i. Recommendations for National Administrators/Regulators

R1 Consider one-stop shop

There is good evidence of one-stop-shops working well in Norway – there are different regulators but they work together through a single contact point for the aquaculture industry to submit licence applications. Critical to the one-stop-shop is an environmental assessment that covers the requirements of all the regulators who sit behind the 'one point of contact'.

R2 Provide vision for aquaculture development to inform spatial planning

This should be broadened out to include several countries that may have overlapping interests in a region (e.g. Baltic, North Sea). The SEA Directive and ESPOO Convention provide certain mechanisms – look at the text in the report on EIA to make sure that the transboundary issues are appropriately covered. Check the balance of the report, e.g. important that freshwater is given equal prominence in relation to planning, although is likely to be covered by terrestrial planning systems.

R3 Integration of aquaculture into R2 of RBMPs

Many of the existing RBMPs make little reference to aquaculture – so future iterations need to give equal prominence to aquaculture as for other activities.

R4 Allocated Zones for Aquaculture

What about allocated zones not suitable for aquaculture, is there a case for including these (e.g. protection zones for wild salmon in Norway – further evidence to be provided in the report)? It was noted that, again, species/system specificity was important in defining locations for aquaculture activities. Expand to include a range of pressures, i.e. not just nutrients. There was a suggestion to terminate the sentence with ‘... in locations that are most suitable.’ Or ‘... in locations that are most suitable for receiving the suite of pressures identified.’ Ultimately the decision will be evidence based. Consider adding a recommendation that an interpretation of the Directive (by the NGOs) is that all/certain types of aquaculture should be in Annex 1 of EIA directive.

R5 adopt risk and evidence based approach

How do we define ‘good science’ – the wording will be checked (ostensibly this is peer reviewed evidence, although even that approach isn’t straightforward). Should it also reference the precautionary principle – no this is already implicit within the use of the word risk. Aquaculture is one of many activities affecting WFD and MSFD so important to maintain proportionality across all sectors.

R6 Improve clarity on parameters / data

Include a recommendation to look at the implementation of various standards. The use of indicators in determining the acceptability of pressures on the environment is important and this should be checked as to whether it is adequately addressed within the report. Data sharing / mapping is important in terms of both compliance with regulatory requirements and feeding into national/EU mechanisms.

R7 precautionary principle should be adopted in a sensible and pragmatic manner

Consensus was that the precautionary principle must be applied and asked whether it does need a specific recommendation. It is superfluous as written – suggestion that the precautionary principle should be applied in line with EEA best practice guidance (i.e. the twelve lessons learnt) and the EU Communication and Cefas will look at these to see how best to amend the recommendation. The main message is that the available evidence is effectively applied in decision making. Examples of where the precautionary principle has not been applied in a ‘sensible and pragmatic manner’ to be explored further (examples from FEAP, and example from the UK for *Crassostrea gigas* cited at the meeting).

R8 Improve monitoring – nutrient loads

Understanding needs to be applied to all sources, not just aquaculture. Technology exists to trace nutrient loads in freshwater back to specific terrestrial sources (e.g. used routinely in Scotland), and this should be developed further to examine specific loadings at catchment/local level. However, does this apply in the marine environment?

R9 Assessment of mitigation tools or practices

There were questions about whether mitigation was acceptable under the WFD / MSFD as the mechanism for protection was a reduction in pressure. Hence, would mitigation of nutrients with algal and mussels culture be acceptable. Germany suggested that it would, as they have 20,000 tonnes of blue mussel production in their MANP.

R10 Consider mechanisms nutrient trading

Difficult to apply – needs a qualifier, e.g. a mass balance approach seems to be important. The focus is to decrease input not compensate for input.

R11 Flexible regulatory framework

Aquaculture is very diverse so important that regulations accommodate this diversity rather than constrain it.

R12 Administration costs should be proportionate to sector regulated

This was agreed and seen to be in line with the polluter pays principle & cost-recovery approach.

R13 National Administrator guidance (e.g. under Art 4.7 WFD) to comply with WFD & MSFD

Suggest develop guidance that addresses both existing and new developments. There should be guidance from National Administrators to help developers assess whether their planned facilities are likely to comply with the WFD and the MSFD. Guidance would probably be needed for the WFD and the MSFD separately. Developers could use such an assessment in support of their application for licences and other permissions. In Germany EMFF is foreseen as a funding opportunity for developing guidance across Federal States etc. This was seen as a potentially useful approach and further detail will be provided in written comments.

R14 National Administrators specific GP guidance

The wording needs to be improved to make it clear that this is guidance is to be produced by NAs for the industry.

4.ii Recommendations for Industry

R1 Liaising with regulators to achieve a common level of understanding

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The least knowledge and experience is in those MS where aquaculture is a new / emerging activity. A licensing body may be different to the NA body with whom the aquaculture sector regularly liaises, e.g. a Fisheries Division rather than EIA/water quality Division. One stop shop (single point of contact) may help facilitate this.

R2 Adopt holistic management systems

Why 'holistic' why not Ecosystem Based Management? The idea is that this is EBM+, i.e. intended to be all encompassing, and would also include fish health and welfare, biosecurity, for example.

R3 Adopt aquaculture production system types appropriate to the local environment

Some comments? No comments received.

R4 continual improvement

Sustainability reports could help develop this, i.e. through life-cycle assessment. Industry already has work developing along these lines (reported by FEAP). The aquaculture sector is a water user not a consumer with RAS provided as an example, i.e. increasingly used in combination with other systems of production within a production cycle for salmon, for instance. The list should include genetic selection. FVO / DGSANCO are undertaking a comprehensive investigation of the use of medicines in aquaculture and are due to report early next year. Expand the text on the economic viability of recirculation systems.

R5 practices of self monitoring

How much of this is already done by, for example organic or AFC certification (including retailer/supermarket standards)? Code of GP in Scotland for salmon adopted by 95% of the sector and there is often a degree of overlap with certification schemes in general. Possible utility for emerging technologies, e.g. aquaponics.

Recommendations for research & further guidance

R1 Support monitoring of BAT for achieving GES

What does this mean – text needs clarifying. There should be improvement of monitoring of aquaculture impacts. Maybe include reference to economic considerations (as raised in workshops). Maybe 'managing' rather than 'reducing'. Careful with the application of the term BAT – wording to be amended. Feed – a lot of work being done but not included within this project as out of scope. Bioeconomy study on biomass imports in Europe (agriculture, aquaculture etc) – food security questions are critical.

R2 more accurate predictive models

The H2020 call may bring in studies on the cumulative effects of these issues.

R3 new & innovative water processing

Did project assess artificially constructed wetlands? We picked up mention of the use of wetlands in the Aqua e-treat project, and also saw an example of traditional Danish earth pond system turned over to wetlands managing effluent from a model farm. There are other examples of circular management systems where different activities are interrelated to manage nutrients in the system (Aquabest project).

R4 offshore development of industry 1 nm+

Look at the precautionary principle and expand the text because if this is an emerging potential it needs more detail. Statement on reduced conflict with other activities etc needs to be better supported / clarified.

New potential recommendations from the Brussels workshop:

R#1 new environmentally friendly materials for fish boxes (not polystyrene)

R#2 Recommendations for the Commission? Guidance needed on how to focus on biological impacts e.g. NIS, sea lice, escapees harmonisation of approaches. Interpretation and implementation of Directives differs between MS how can this be standardised – EU stated that this is the nature of Directives and that the Regional Sea Conventions can support the coordination between Member States in achieving GES. The project has accumulated a wealth of information which although out of scope is a valuable resource for future use.

End

Annex 10: Activities of the four Regional Seas Conventions (Barcelona, Bucharest Helsinki and OSPAR) and other regional environment/fisheries organisations in relation to aquaculture in EU waters.

Annex 10.1 Barcelona Convention – ‘The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean’

The convention created several protocols which aimed to reduce pollution in the Mediterranean, one of which was the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean. Under this protocol, a Regional Activity Centre for Specially Protected Areas (RAC/SPA) was established to enforce the protocol by creating a network of Specially Protected Areas across the Mediterranean as well as to implement an Action Plan on invasive species. This Action Plan, adopted by the Contracting Parties to the Barcelona Convention in 2003 (UNEP/MAP/RAC/SPA 2003), specifically deals with aquaculture. In 2005 an Action Plan concerning species introductions and invasive species in the Mediterranean Sea was published (UNEP/MAP/RAC/SPA 2005). Guidelines for controlling vectors of species introduction were developed in 2008 (UNEP/MAP/RAC/SPA 2008a) and a guide for risk analysis of the impacts of the introduction of non-indigenous species was also published in 2008 (UNEP/MAP/RAC/SPA 2008b). In 2011 an information document on non-native species in the Mediterranean was published (UNEP/MAP/RAC/SPA 2011).

An assessment of the economic value of sustainable benefits provided by the Mediterranean Sea marine ecosystems was published in 2010 that included aquaculture (Mangos et al 2010). UNEP, in its capacity as Secretariat of the Mediterranean Action Plan, agreed a Memorandum of Understanding with the Food and Agriculture Organisation of the United Nations on behalf of the General Fisheries Council for the Mediterranean in 2012 which includes cooperation in the mitigation of the impact of fisheries and aquaculture on the marine habitats and species.

Annex 10.2 Bucharest Convention – ‘The Convention on the Protection of the Black Sea against Pollution’

A Black Sea Strategic Action Plan (BS SAP) was adopted in 1996 and updated in 2009 (BSC 2009). Within the BS SAP there are a number of guiding principles, one of which ensures that environmental and health considerations are included in all relevant policies, sectoral plans and programmes, including those activities relating to aquaculture. The Action Plan also mentions specific challenges to be faced, some of which are relevant to aquaculture, including, eutrophication/nutrient enrichment, commercial marine living resources and alien species introductions. The Action Plan also notes that aquaculture is not strongly developed in the region and there is scope for it to be developed, providing environmental considerations are taken into account.

Annex 10.3 Helsinki Convention – ‘The Convention on the Protection of the Marine Environment of the Baltic Sea Area’

The Helsinki Convention has had an involvement in aquaculture for many years going back to at least 1994 when the Helsinki Commission (HELCOM) adopted Decision 15/3 on measures aimed at reducing discharges from marine fish farming. That decision was updated several times with the latest being adopted in 2004 (HELCOM 2004). By adopting the Baltic Sea Action Plan in 2007, the HELCOM Contracting Parties agreed to consider aquaculture as one of the sources of eutrophication impacts. Some estimates of nutrient inputs originating from fish-farming are available from source-apportionment within periodic Baltic-wide Pollution Load Compilations (HELCOM 2011). An updated version of the report PLC-5.5 will be available by the end of 2014.

Aquaculture was one of the activities assessed as part of the assessment of the ecosystem health of the Baltic published in 2010 (HELCOM 2010a). Aquaculture featured as a pressure for alien species introductions and the introduction of nutrients, organic matter and pathogens. HELCOM published a background report to the methodology and data of the Baltic Sea Pressure Index (BSPI) and the Baltic Sea Impact Index (BSII) used in that assessment (HELCOM 2010b). In a HELCOM implementation report on the status and ecological coherence of the HELCOM BSPA network (HELCOM 2010c), while aquaculture was indicated to be a potential threat to Baltic Sea MPAs, it was ranked 20th in a list of threats.

HELCOM has developed indicators for evaluating whether the targets of the Baltic Sea Action Plan have been met (HELCOM, 2012; 2013b) and these include indicators related to aquaculture . HELCOM has worked on alien species introductions but appears to have been primarily concerned

with ballast water from shipping (HELCOM, 2012b, HELCOM, 2013 and Rolke et al., 2013). Aquaculture was responsible for about 13% of the introductions.

The HELCOM Copenhagen Ministerial Declaration made on 3rd October 2013 in Copenhagen, Denmark (HELCOM 2013c) included the following statement on sustainable aquaculture:

“22 (B). HIGHLIGHTING the increasing importance of sustainable aquaculture, WE AGREE to develop a new HELCOM Recommendation on sustainable aquaculture by 2014 to substitute the existing HELCOM Recommendation 25/4 aiming at limiting potential environmental impacts of aquaculture activities such as the introduction of non-indigenous species, ecological and genetic impacts on wild fish stocks from unintended releases of farmed species, nutrient pollution, as well as introduction of antibiotics and other pharmaceuticals”.

Following the 2013 HELCOM Ministerial Meeting, the HELCOM Secretariat has started drafting an update of HELCOM Recommendation 25/4 regarding measures aiming at sustainable aquaculture in the Baltic Sea Region.

Annex 10.4 OSPAR Convention – ‘The Convention for the Protection of the Marine Environment of the North-East Atlantic’

The OSPAR Convention and one of its predecessors the Paris Convention 1974 have had a limited involvement with mariculture (as it only covers the marine environment) as detailed below. Under the Paris Convention, ‘The Convention for the Prevention of Marine Pollution from Land-Based Sources’, PARCOM Recommendation 94/6 covered ‘Best Environmental Practice (BEP) for the Reduction of Inputs of Potentially Toxic Chemicals from Aquaculture Use’ was adopted in 1994 (PARCOM 1994). This recommendation continued in force under the OSPAR Convention when that Convention came into force in 1998. The Recommendation covered in particular the drawing up by national authorities of Codes of Best Environmental Practice (BEP) and action plans. The Recommendation required reporting of implementation by the Contracting Parties and at the OSPAR Commission meeting in 2006 it was decided that no further implementation reporting was required (OSPAR 2006a). The final implementation report was published by OSPAR in 2006 (OSPAR 2006b).

At that same 2006 meeting, the OSPAR Commission agreed a background paper on mariculture (OSPAR 2006c) that covered hazardous substances, eutrophication and habitats/biodiversity issues.

The conclusions of that document were:

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“The mariculture industry is very diverse. Its impacts are mostly site-specific. Regulation and control will therefore always need to be focused on a case-by-case approach, although the competent authorities need to ensure at the same time that the overall pressure from aquaculture on the marine environment does not compromise the marine environment. A substantial amount of general guidance is available to give the background to these case-by-case decisions. OSPAR has therefore concluded that, in present circumstances, there is no need for the development of additional programmes and measures at the OSPAR level.”

Subsequently, an assessment of the impacts of mariculture was produced in 2009 (OSPAR (2009)) that was fed into the OSPAR Quality Status Report (OSPAR 2010). Most recently, the OSPAR Environmental Impacts of Human Activities (EIHA) Committee that met in April 2014 considered a paper on the pressures from mariculture (OSPAR 2014) that included information provided by Norway and Spain and included a work plan on the interaction between wild and caged stocks that the International Council for the Exploration of the Sea (ICES) will report on in 2015. At the meeting, all Contracting Parties were encouraged to report any new information on mariculture to EIHA.

Annex 10.5 International Council for the Exploration of the Sea (ICES)

The ICES Working Group on Aquaculture (WG AQUA) was recently (2013) established as a single working group dealing with science and advice for sustainable aquaculture in the ICES area. The work focuses on aquaculture-environment interactions with the current Terms of Reference (ToR) posted on the ICES website at:

www.ices.dk/community/Documents/Science%20EG%20ToRs/SSGHIE/WGAQUA%20multiannual%20ToRs%202013.pdf.

Annex 10.6 General Fisheries Council for the Mediterranean (GFCM)

The GFCM has a significant involvement with aquaculture with a Committee on Aquaculture (CAQ). At its 7th session in 2011 (GFCM 2011a), the CAQ recommended that specific regulations and the simplification of licensing procedures for aquaculture, e.g. “single windows or one-stop shop”, should be implemented. It formulated specific management advice on the implementation of Allocated Zones for Aquaculture (AZA) in countries aiming to facilitate and develop aquaculture. It also recommended the implementation of an environmental monitoring programme in the areas surrounding aquaculture activities. The Committee considered some amendments for the Recommendation GFCM/33/2009/4 on Reporting on Aquaculture Data and Information. At its 8th session in March 2013 (GFCM 2013a), the CAQ decided to develop a draft set of guidelines for the [Background information for sustainable aquaculture development, addressing environmental protection in particular](#)

use of indicators to monitor the sustainable development of aquaculture in the GFCM area as well as to carry on activities and research on allocated zones for aquaculture (AZA). In light of the increasing role to be played by farmers' organisations in the development of sustainable aquaculture, a proposal to set up an aquaculture multi-stakeholder platform was tabled at the CAQ to increase knowledge capital and improve cooperation in the sector. This was subsequently submitted to the 37th GFCM session. The CAQ welcomed the initiative to undertake a regional review on the current status of aquaculture in the GFCM area.

At its 37th annual session in May 2013 (GFCM 2014), the GFCM renewed its commitment to foster the sustainable development of aquaculture in the Mediterranean and the Black Sea through the establishment of a multi-stakeholder platform involving all players in the sector. The GFCM held a meeting in December 2013 to launch the multi-stakeholder platform to tackle the challenges faced in the sustainable development of aquaculture in the Mediterranean and Black Seas (GFCM 2013b).

The GFCM has published two reports on indicators related to sustainable development of aquaculture (GFCM 2013b; 2013c) and held a 'Regional workshop on the identification of reference points for economic, environmental, social and governance indicators on aquaculture' in 2013 (GFCM 2013c). The GFCM has an 'Information System for the Promotion of Aquaculture in the Mediterranean' on its website at <http://www.faosipam.org/index.aspx?pag= home>.

Annex 11: Development of Environmental Indicators for Aquaculture.

The identification of indicators of the environmental impact would support the development of a sustainable aquaculture industry by assessing impacts of operations, the effectiveness of measures to mitigate potential adverse impacts, and changes over time. Sets of common, reliable and easy to measure indicators, to be used as a proxy for potential or actual environmental impact, therefore need to be developed. Unfortunately, this is challenging because they need to account for significant variations, in both production practices and the environment, e.g. the environmental indicators required to monitor intensive marine net-pen salmonid production systems common in Northern Europe will be different to those required for central European extensive freshwater carp farms. In general, indicators should be developed to monitor the three main envisaged pressures on the environment

- Nutrients (eutrophication) (Section 10.1)
- Contaminants e.g. chemicals (Section 10.2)
- Introduction of alien species (Section 10.3)

The European Environment Agency (EEA) has undertaken some work to develop an indicator that quantifies the development of European aquaculture production by major sea area and country, as well as the contribution of aquaculture discharges of nutrients relative to the total discharges of nutrients into coastal zones (<http://www.eea.europa.eu/data-and-maps/indicators/aquaculture-production-1>). The EEA recognises that the indicator, although simple and readily available, has limited applicability as a stand-alone indicator, as it takes inadequate account of the widely varying production practices and is restricted to marine production systems. The EEA would like such indicators to be integrated with others related to production practices (e.g. total nutrient production, total chemical discharge) to generate a more specific indicator of pressure. Coupled with information on the assimilative capacity of different habitats, such an indicator would allow estimation of impact and ultimately the proportion of the carrying capacity of the surrounding environment used and the limits to expansion.

The European Pollutant Release and Transfer Register <http://prtr.ec.europa.eu/IndustrialActivity.aspx> does publish information on discharge of 91 pollutants from intensive aquaculture into the

environment. However at the present time information is mainly restricted to discharges from large intensive marine aquaculture sites

The JRC has also published guidance on an approach towards general European aquaculture performance indicators (Hofherr et al 2012), see Table Annex 11.1. They selected, as part of this exercise, Environmental indicators based on parameters specific to production systems which are considered similar across Member States.

Table Annex11.1: Environmental indicators selected by JRC (Hofherr et al 2012)

Indicator	Description
Fishmeal (FM)	Ratio between total quantity of fishmeal used and total aquaculture production
Fish oil (FO)	Ratio between total quantity fish oil used and total aquaculture production
Nitrogen (N)	Ratio between total effluents of nitrogen and total aquaculture production
Phosphorus (P)	Ratio between total effluents of phosphorus and total aquaculture production

There have also been regional efforts to recommend sets of indicators to be used to measure the sustainability of aquaculture which include measures of environmental sustainability. For instance, there has been significant efforts by the GFCM to develop indicators for sustainable aquaculture in the Mediterranean and Black seas regions(GFCM 2011b; 2013c; 2013e). Five indicators for environmental impact were identified (Table Annex 11.2): food conversion ratio, site selection criteria, monitoring for chemical and medicines residues, monitoring for impacts on benthos and reports of escapes.

Table Annex 11.2: Environmental indicators for sustainable aquaculture in the Mediterranean and Black seas Regions (Fezzardi et al 2013)

	Principle	Criteria	Indicator	Reference values
1	Minimize the global impact of aquaculture	Needs of natural resources for food production (pelagic fish and plants)	FCR - feed conversion ratio (kg food/kg fish)*	Seabass (350-400 gr): > 2.2/2.2-1.8/<1.8 Seabream (300-350 gr): >2.1/2.1-1.6/<1.6
2	Maintain the ecological services of ecosystems	Reduction of benthic environmental impact	Existence of criteria for the depth (m) of cage applied to site selection. Related to density. Ratio of depth and density (depth (m)/ density (kg/m ³))	< 1.5 / 1.5 –2 / >2**
3	Minimize the local impact on environmental conditions and biodiversity	Use of chemical products	Existence of a national monitoring programme to monitor antibiotics and other chemical residues	Yes/No
4		Impact on benthic habitats and	Implementation of a monitoring system for the	Yes/No

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		communities	evaluation of the level of impact on benthos	
5		Biological impact on communities	Reporting of escapees (number of escape events)	Yes/No

Conclusions

There is a need to establish a harmonised approach to the selection and interpretation of indicators for monitor the environmental sustainability of aquaculture operations. The indicators selected by different organisations have varied, relating to the original purpose they have been selected for. Of the sets of indicators referenced, only those proposed by GFCM (2013e) cover all three of the main envisaged environmental pressures. Their general applicability, particularly to EU-wide marine aquaculture operations, should be explored.

Annex 12: Planning for Sustainable Blue Growth.

Blue Growth (COM 2012) is the long term strategy to support sustainable growth in the marine and maritime sector, recognising that the marine environment has great potential for innovation and expansion. While the EU blue economy is already worth just under €500 billion p.a., the strategy highlights where there is the possibility of further sustainable growth. The strategy consists of three components: specific integrated maritime policy measures (e.g. marine spatial planning); sea basin strategies (e.g. in the Baltic); targeted approaches to develop specific activities, one of which is aquaculture.

The aims of the environmental legislation are an integral part of the blue growth agenda. The Blue Growth Strategy is all about prioritising the use of ocean resources sustainably as a driver for growth and jobs in Europe (Damanaki 2014).

Annex 12.1 Overview of the importance of strategic planning for aquaculture

Given that the output from European aquaculture has been fairly constant since 2000, but global aquaculture production has been growing at nearly 7% p.a., there is a drive from the EC to increase sustainable domestic production as part of the blue growth strategy. The Commission hopes to develop aquaculture through the Common Fisheries Policy reform, together with a set of strategic guidelines (COM 2013) to aid cooperation and identification of common objectives and indicators. It is clear that there is an important need for strategic planning of aquaculture activities to ensure linkage across Member States, with the guidance identifying four priority areas for development:

Annex 12.1.1 Reducing administrative burdens

Administrative burdens (such as cost and licensing time) could be having an important impact on the current development and competitiveness of European aquaculture, and there is a push from the EC to reduce the regulatory burden on producers. Ongoing work includes: determining the different types of administrative burdens for different aquaculture activities, asking MS to compile information concerning costs and timescales of licence determinations, and developing best practice and measures for improvement.

Annex 12.1.2 Coordinating spatial planning

Currently, lack of space is often cited as a factor hindering the expansion of EU marine aquaculture. Strategic planning includes the development and application of spatial planning and integrated coastal zone management to identify appropriate sites for aquaculture activities. Spatial planning allows different activities to be examined in an integrated way within a defined region, allowing site planning of each activity within the region to maximise economic and societal benefit, minimise environmental impact and prevent conflict within sectors where possible. (N.B. Such planning will need to take account of the recently-agreed EU Directive on maritime spatial planning.)

Annex 12.1.3 Increasing competitiveness

There are plans to improve the structure of aquaculture producer organisations, to reform the Common Market Organisation and implement a new European Maritime and Fisheries Fund in order to increase the competitiveness of EU aquaculture. The EU Market Observatory will help producers identify business opportunities (including diversification) and adapt their marketing strategies. Improving links between R&D and industry, as well as supporting educational and vocational programmes for the aquaculture sector will also aid in developing competitiveness.

Annex 12.1.4 Exploiting competitive advantages

Europe has some of the highest standards in environmental, animal health and consumer protection, which potentially gives the EU a competitive advantage over other nations. European consumers are displaying an increased environmental responsibility, with demand for sustainable/certified fish products and organic produce growing.

Annex 12.2 Emerging issues

The Blue Growth agenda provides a clear framework for the further development of economic activities in our oceans, seas and coastal areas. However, this growth can only be developed to its full potential if it operates within the sustainable boundaries of the marine environment. There is strong evidence to suggest these boundaries are under severe pressure, and will be breached unless corrective action is taken. Meeting the 2020 goal of achieving Good Environmental Status, and thereby safeguarding the basis for sustainable blue growth requires commitment, cooperation and above all action (EU Environment Ministers Europe 2014).

Annex 12.3 Horizon 2020

Horizon 2020 is the financial instrument being used to promote research and innovation in Europe, and represents a key implementation tool of Europe 2020, the EU's growth strategy for the next

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decade. H2020 will provide nearly €80 billion over 7 years (2014 – 2020). It is seen as a means to drive economic growth and create jobs. The overall programme is divided into a number of ‘Societal Challenges’, one of which is sustainable food provision, in which aquaculture is specifically mentioned. Overlaying this are cross-cutting ‘Focal Areas’, one of which is Blue Growth. SMEs and industrial partners are strongly encouraged to take part, with a much simplified funding model applying to all potential partners. In addition, there is a specific funding model to encourage individual SMEs to submit funding proposals to take innovative ideas closer to market. It is clear that there excellent opportunities for European aquaculture to benefit from this programme.

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Annex 15: Presentations provided at the Regional Workshops

Athens	https://circabc.europa.eu/w/browse/011378ee-7630-4d7b-926c-28f82c937b5b
Dublin	https://circabc.europa.eu/w/browse/71df8a19-da6a-4752-8f40-ed2f359f240
Vienna	https://circabc.europa.eu/w/browse/6d84d387-27d3-4c56-aa2a-55e1ce199ad7
Copenhagen	https://circabc.europa.eu/w/browse/444c8968-20db-4da1-a123-29ea913ed21a

	Title	Presenter	Organisation	Workshop
1	'Environmental Interactions in Aquaculture: Implications for Site Selection and Carrying Capacity in the Mediterranean'.	Ioannis Karakassis	Biology Department, University of Crete	Athens
2	'Sustainable aquaculture development: the case of organic aquaculture	Elena Mente	School of Agriculture, Dept of Ichthyology & Aquatic Environment, University of Thessaly, Greece	Athens
3	'When the environment needs aquaculture: "Valliculture'	Andrea Fabris	Italian Fish Farmers Association	Athens
4	'Aquaculture spatial planning as a good practice to mitigate environmental conflicts'	P. Panayotidis	Hellenic Centre for Marine Research (HCMR)	Athens
5	Examples of good practices of improved environmental performance in Greece	Konstantinos Koutsis	General Directorate for Fisheries – Directorate for Aquaculture & Inland Waters; Ministry of Rural Development and Food	Athens
6	'Ecosystem impacts of intense aquaculture practices in the Aegean Sea, and our proposal on sustainable practices'	Anastasia Miliou	Archipelagos Institute of Marine Conservation, Greece	Athens

7	'A case study of identifying indicators for sustainable marine aquaculture in Izmir/Turkey'	Güzel Yücel Gier	Dokuz Eylül University, Institute of Marine Sciences and Technology, Inciralti-Izmir/Turkey	Athens
8	Mediterranean-On: Sustainability indicators for aquaculture sea cages in the Mediterranean'	Cristina García Diez	Spanish Aquaculture Observatory Foundation	Athens
9	Aquaculture farming, 14 years after Naylor, R. paper (Nature, 2000)	Gianluca Fiore	JRC	Athens
10	'Implementation of the MSFD and WFD in relation to aquaculture'	Nikos Anagnopoulos	APC Advanced Planning Consulting SA	Athens
11	'Implementing the WFD in Galicia Costa (NW Spain)'	Luz Arregui Maraver	ESACUA, Asociación Nacional de Productores de Acuicultura Continental, Galicia/Spain	Athens
12	'Mediterranean Fish Farming: to grow, or not to grow'	Philippos Papageorgiou	Kefalonia Fisheries, Greece	Athens
13	'Creating Frameworks of Good Practice'	Andrea Fabris	FEAP	Athens
14	'The Sustainable Seafood Coalition: A voluntary approach to best practice'	Katie Miller	Sustainable Seafood Coalition	Athens
15	'National Spatial Plan for Aquaculture- Greece'	Lena Karka	Ministry for the Environment, Energy and Climate Change, Greece	Athens
16	Code of good conduct for mussel seed movements	James Wilson	Deepdock Ltd.	Dublin
17	The Irish approach to Sea Lice management	Dave Jackson	Marine Institute	Dublin
18	From Oyster Reference Centre to Aquaculture Regional centre; Virtuous practices synergy with the environment as a model for aquaculture development	Aude JOUAUX	Chargée de mission aquaculture, Conseil Régional de Basse Normandie	Dublin
19	Aquaculture Environmental Management Systems	Grainne O'Brien	BIM	Dublin

20	Relevant tools for management of wild salmon and impact of aquaculture in Norway	Jo H. Halleraker	Norwegian Environment Agency	Dublin
21	PREVENTION OF ESCAPEES	Knut A. Hjelt	FHL (Norway)	Dublin
22	Closed Containment Salmon Farming	Bob Seward	European Anglers Alliance	Dublin
23	Monitoring to manage our marine resources	Catherine McManus	Marine Harvest Ireland	Dublin
24	Interactions Management for Mutual Benefit	Alex Adrian	The Crown Estate	Dublin
25	Industry best practice – food safety	Jerry Gallacher	Irish shellfish association	Dublin
26	Aquaculture of White Clawed Crayfish and Fresh Water Pearl Mussels	Keith Jeffery	obo Natural Resources Wales	Dublin
27	Norwegian aquaculture: Balancing increased food production and environmental sustainability	Yngve Torgersen and Tor Simon Pedersen	Norwegian Environmental & Fisheries Authorities	Dublin
28	Good water quality downstream and pollution alerts	Mandy Pyke	Seafish	Dublin
29	NGO priorities for environmentally sustainable aquaculture in the EU	Ann Dom	Seas at Risk	Dublin
30	The CLAMS process - 'integrating aquaculture into local communities or creating social licence for aquaculture at a local level'	Donal Maguire	BIM	Dublin
31	Aquaculture Regulation and Scotland's Aquaculture Database	Douglas Sinclair	SEPA	Dublin
32	'Creating Frameworks of Good Practice'	Phil Thomas	FEAP	Dublin
33	Galicia fish farm planning	Javier Ojeda	Galicia Fish Farmers	Dublin
34	Ireland Implementation	Cian Ó Lionáin	DECLG	Dublin
35	UK / English Implementation	Elaine Connelly	Defra	Dublin
36	'Implementation of the WFD: aquaculture areas in the River Basin Management Plans'	Lourdes Alvarellos	DG ENV	Vienna
37	WFD & Aquaculture, a contradiction in terms or potential for a symbiotic	Bernhard Feneis	FEAP	Vienna

relationship

38	Zeolites the Aquaculture Holy Grail	Daniel Tabarcaru	Caviar Factory	Vienna
39	Sustainable carp farming and the WFD	Ferenc Lévai Jr	Aranypony ZRt – Deputy Manager	Vienna
40	“Strategies for breeding local autochthonous fish populations for aquaculture and for restocking in accordance with WFD”	Franz Lahnsteiner	BAW	Vienna
41	Aquaculture good practice in relation to WFD in Poland.	Anna Wisniewska	Polish Trout Breeders Association and University of Warmia & Mazury	Vienna
42	Bird Control on aquaculture ponds?	Jurgita Skorupskaitė	Ministry of Agriculture of the Republic of Lithuania	Vienna
43	“Conservation hatcheries – A case study for Danube salmon and European grayling”	Thomas Friedrich	University of Natural Resources and Life Sciences Institute for Hydrobiology and Aquatic Ecosystem Management	Vienna
44	Best practice and innovation in freshwater aquaculture in line with the WFD	Szilvia Mihálffy	Ministry for Rural Development , Hungary	Vienna
45	When environment needs aquaculture: some examples from Italian Fresh water aquaculture	Pier Antonio Salvatore	Associazione Piscicoltori Italiani	Vienna
46	The Lost EU Projects	Alastair Lane	European Aquaculture Society	Vienna
47	Improved water quality using solar feed spreaders	Dana & Georghy Bedreaga	Delta Plus	Vienna
48	Good practises according to European Consumer Guides ~ Fresh water ~	Margareet Van Vilsteren	North Sea Foundation	Vienna
49	Aquaculture and conservation breeding, conflict or concurrence? the Danube sturgeon example	Ralf Reinartz	Danube Sturgeon Task Force (DSTF)	Vienna

50	Maintaining wetland ecosystem services through responsible aquaculture practices	Irene Lucius	WWF Danube and Carpathian areas	Vienna
51	Developing a national aquaculture strategy in line with the WFD and river basin management plans	Tamas Bardocz	Ministry of Rural Development, Hungary	Vienna
52	"Aquaculture part of the problem or part of the solution?"	Catalin Platon	ROMFISH, National Association of Fish Producers	Vienna
53	Aquaculture in the Black Sea: management, environmental implications and sustainability	Violin St.Raykov	IO BAS, Department "Marine biology and ecology" EWG Black Sea,STECF,EC, Vice Chair WG Black Sea,GFCM FEAP	Vienna
54	Creating Frameworks of Good Practice'	Ferenc Lévai Jr		Vienna
55	Some aspects related to the transposition and implementation of WFD and MSFD in Romania	Otilia Mihail	Ministry of Environment and Climate Changes Department on Water, Forest and Fisheries	Vienna
56	"Lessons from the 'AQUABEST' project for development of a sustainable aquaculture industry in the Baltic region that meets environmental obligations'	Jouni Velma	AQUABEST coordinator	Copenhagen
57	Creating Frameworks of Good Practice'	Anu-Maria Sandelin	FEAP	Copenhagen
58	Growth versus environment: Danish Industry Perspective	Brian Thomsen	Danish Aquaculture Organisation	Copenhagen
59	Recirculated land-based aquaculture	Jesper Heldbo	Aquacircle	Copenhagen
60	Mussel production as a mitigation to extract nutrients from finfish farming	Per Dolmer	Baltic Blue Growth Partnership	Copenhagen
61	Aquaculture and Sea-Ranching	Florian Mühlbauer	Rostock University	Copenhagen
62	Aquapri	Julia Overton	Aquapri	Copenhagen
63	Aller Aqua A/S	Ole Schmidt	Aller Aqua A/S	Copenhagen

64	Lessons from the AQUAFIMA project	Marco Frederiksen	EUROFISH	Copenhagen
65	Aquaculture farming, between environmental impact and need of development	Gianluca Fiore	JRC	Copenhagen
66	Baltic sustainable aquaculture - how do we get there?	Nils Holglund	Coalition Clean Baltic	Copenhagen
67	Priorities for environmentally responsible aquaculture in the EU	Ann Dom	Seas at Risk	Copenhagen
68	'HELCOM recommendations for sustainable aquaculture development in the Baltic Sea, with special reference to implementation of WFD, MSFD and other environmental regulations'	Marco Milardi	HELCOM	Copenhagen
69	Aland Islands and Finnish Experiences	Jenny Eklund-Melander	Aland Islands Government	Copenhagen
70	Swedish Aquaculture	Malin Skog	Swedish Board of Agriculture	Copenhagen
71	Danish regulatory approach to develop sustainable Sea trout farming using mussels, <i>Mytilus edulis</i> and seaweed, <i>Saccharina latissima</i> to compensate for discharged nutrients N and P	Anders Vedel	Danish Ministry of the Environment	Copenhagen
72	Estonian Aquaculture	Eduard Koitmaa	Ministry of Agriculture, Estonia	Copenhagen
73	Aquaculture in freshwater ponds in Poland – the way to protect environment	Igor Wawrzyniak	Ministry of Agriculture and Rural Development (MARD) the Department of Fisheries	Copenhagen
74	Finnish Aquaculture	Anu-Maria Sandelin	Finnish Fish Farmers Association	Copenhagen
75	Aquaculture in Latvia	Inese Mikelsone	Department of Fisheries, Ministry of Agriculture of Latvia	Copenhagen

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