Working Group Name: Study Group on Socio-Economic Dimensions of Aquaculture (SGSA)

Executive summary

The 1st meeting of the Study Group on Socio-Economic Dimensions of Aquaculture (Chair: Gesche Krause, Germany) was held in Bremen (Germany) between April 12-14 and was attended by 6 participants from Germany, Spain and Sweden (and Norway via Skype) (Annex1). The objective of the meeting was twofold: (1) to create a new group that has an explicit focus on socio-economic issues of marine resource uses and (2) to work on the Terms of Reference that were decided upon at the SCICON meeting in 2010. The ToRs were addressed separately within subgroups, followed by plenary sessions where subgroup activities were discussed by the full members of SGSA. Since it was the first meeting of this group and a novel topic to ICES that pulled together scientists with a wide range of different scientific backgrounds, the group agreed on a common scope and perspective which the SGSA will have in the future. These are summarized in a background chapter in the beginning of this report (Chapter 3).

ToR a) review the progress on how to evaluate the direct and indirect socioeconomic consequences of the use of marine space by aquaculture,

It is recommended to continue ToR a and to identify related science advisory needs for maintaining the sustainability of living marine resources. This will require a close link to all relevant ICES activities on related subjects by other working groups (e.g. WGMASC, WGEIM, WGICZM). Several more specific recommendations stemmed from the work on this ToR. It is recommended that a clear definition of socio-economic and ecological objectives for all aquaculture operations is necessary which acknowledge the social, economic and ecological dimensions. A stronger consideration of the distribution of benefits (related to inputs and outputs) throughout the social-ecological system is recommended. Specifically, this dimension addresses questions about *who* is benefiting and to what extent (i.e. employment, wages, improved quality of life) and the geographical distribution and of these benefits. Future research should focus on methods for incorporating such complexity and interdisciplinarity into aquaculture assessments. Further, it is recommended to rephrase this ToR to "Develop, identify and evaluate methods on how to assess the direct and indirect socio-economic consequences of aquaculture operations and how they relate to an assessment framework." (Chapter 4)

ToR b) Review the potentialities for identifying and strengthening local stakeholder inclusion and local ownership in the aquaculture production chain.

This ToR shall be continued in the next year and addressed in more detail as there was not ample time to look into these aspects in comprehensive detail. The plenary discussions of the group resulted in the recommendation to rephrase this ToR to "review the role of local stakeholder inclusion and local ownership in the aquaculture production chain" (Chapter 5).

ToR c) Address how social values and administrative organizations in different countries/regions affect trends in the intensity, methodology, acceptance, structure and type of aquaculture.

Many aquaculture assessments focus primarily on the impacts of the activity without enough consideration of the framing conditions that are driving those impacts or that influence how the impacts are managed. Understanding the local context (social, political, environmental, economic) is critical to the effective evaluation and management of aquaculture scenarios. This is especially pertinent with respect to socio-economic framing conditions which are often overlooked in scientific studies. It is recommended to develop/review a methodological framework and tools for the assessment of socio-economic framing conditions. Potentially amenable tools include Rapid Rural Appraisal (RRA), Sustainable Livelihoods Approach (SLA) and New Institutional Economics (NIE). The SGSA recommends that future research related to aquaculture should place more emphasis on these dimensions (Chapter 6).

ToR d) Identify new emerging issues of socio-economic aspects of aquaculture

This ToR proved useful to raise critical points within the SGSA that need to be considered in the future. Two issues were found to be of high importance here: The SGSA recommends to revise the forthcoming Aquaculture Report of STECF (Scientific, Technical and Economic Committee for Fisheries) in order to assess if ICES needs are met or how this could be ensured. In addition it is recommended to revise the underlying EU Data Collection Framework (DCF) Commission Decision 2010/93/EU on Council Regulation (EC) No 199/2008 as well as the Aquaculture Statistic Regulation (REGULATION (EC) No 762/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL) of the EU in order to assess if ICES needs are met or how this could be ensured.

1 Opening of the meeting

The ICES Study Group on Socio-Economic Dimensions of Aquaculture [SGSA], chaired by Gesche Krause (Germany), held its first meeting in Bremen (Germany) on 12–14 April 2011 at the Leibniz Center for Tropical Marine Ecology (ZMT).

The meeting was opened at 9:00 on Tuesday 12 April, with the host Gesche Krause, chair of the SGSA, giving housekeeping information and Hildegard Westphal, director of the Leibniz Center for Tropical Marine Ecology, welcoming the groups at the ZMT. The chair welcomed the members to the meeting and thanked the participants for their willingness to engage in this new group and their respective institutions for allowing time and money to participate. It is becoming increasingly difficult for institutes to allocate resources for the ICES meeting. For instance, one member from France was not able to come because of lack of funds, one member from Canada was forced to withdraw from attending due to lack of support from his institute. Another colleague from Norway, who was not able to attend personally, contributed to the meeting via email and Skype.

The Agenda of the meeting was formally adopted (Annex 2). The first day of the meeting was devoted to the identification of subjects of mutual interest to the diverse range of different disciplines involved in this new group. It was discussed in a plenary session at the beginning of the first and second day what issues would be most relevant for ICES, since this study group being a first trail effort on incorporating social sciences more strongly. The outcome of this discussion and further discussions with the separate groups is presented in paragraph 3. as background and scope of the SGSA. As a spin-off, a framework was developed to assess and analyze the different socio-economic dimensions of aquaculture and was then applied to tailor the analysis within the subsequent ToRs.

2 Adoption of the agenda

The agenda (Annex 2) was formally accepted. A general discussion about plans for each SGSA Term of Reference was held. The SGSA decided to discuss the ToRs initially in a plenary session to understand the background and viewpoints of each of the members of this new group and to formalise a common framework of analysis of the socio-economic dimensions of aquaculture. Since the group was only 6 members the ToRs were critically reviewed to see how the work could be organised best. It was felt that the group first needed to capture the way of analysing the issues by developing jointly a framework for integrated assessment of the socio-economic dimensions of aquaculture.

By midday on the second day, the group continued to address ToR a separately within subgroups, followed by plenary sessions where subgroup activities are discussed by the full SGSA and the draft report was formally accepted. ToR b and c were tackled marginally, which was attributed to the fact that the group was rather small and still in the process of formalizing. It was decided to address ToR d (*identify new emerging issues of socio-economic aspects of aquaculture*) in plenary sessions.

By the end of the third day, the ToRs were revisited and rephrased according the experiences and discussion made during the meeting. Theses amendments are now incorporated in the new ToRs for the next meeting in 2012.

3 Background and Scope of this Study Group

Globally and regionally, consumption of living marine resource is increasing to levels that cannot be sustained by our oceans. The rapid development of aquaculture has been a remarkable contributor to meeting this growing demand; it has now risen to provide half of all fish destined to human consumption (FAO 2009) and is widely forecast to grow further. The gap between demand and supply is, however, increasing and the pressure is on aquaculture to develop even faster, which will require input from a wide range of social, technological, economic and natural resources (FAO 1996; 2000; 2002). North American and European markets have traditionally sourced very widely and have also stimulated a sizable aquaculture sector in their territorial waters.

However, its growth rate in Europe (excluding Norway) is slowing down whilst, at the same time, the more recent growth of aquaculture imports, particularly from Asia, are likely to become more limited. . This can be related to the fact that incomes in producer countries like China and India are growing in par with urbanization and the aspirations of a growing middle classes, all driving up demand and per capita seafood consumption of higher valued species. The European Union (EU27) imported €15.2 billion worth of fish and fishery products in 2009, accounting for more than 60%

of it fish consumption (EUROSTAT). Total aquaculture production in the EU is only around 1.3 million tonnes (EUROSTAT) and of total seafood import a significant contribution comes from Asian aquaculture. EU will therefore increasingly have to depend on new exporting countries. Together with consumers and markets operating more globally, it will also have to do so amidst growing uncertainties of supply, market, production and trade conditions brought about through climate change. The search for resilient solutions in the aquaculture sector to meeting production, income, community development and food supply and security needs will be critical for the ICES countries and their global partners.

Aquaculture increasingly generates direct socio-economic benefits through the supply of highly nutritious foods and other commercially valuable products, providing jobs and creating incomes. In addition to its own economic contribution, aquaculture can also induce, as a spin-off, economic contribution to other sectors that supply materials to aquaculture or use aquaculture products as inputs. Thus the numbers of people engaged in other ancillary activities, such as processing, farm construction, manufacturing of processing equipment, packaging, marketing and distribution can be substantial. Indeed, estimates indicate that, for each person employed in aquaculture production, about three other jobs can be produced in secondary activities. Thus, fishers, aquaculturists and those supplying services and goods to them provide employment and livelihoods of a total of about 180 million people (FAO 2010).

Despite these positive effects, aquaculture also competes for economic, social, physical and ecological resources, and can result in environmental degradation. Its development may therefore generate negative impacts on other industries and people's livelihoods (e.g. fisheries, agriculture, and tourism). Decisions about aquaculture development are often based on incomplete information, particularly in relation to the socioeconomic dimensions. As a consequence, inadequate accounts for how trade-offs associated with different development options are made. Examples include aquaculture expansion in certain areas directly affecting resource systems that may already be under large pressure from other human activities. There is therefore a risk that anticipated and much needed socio-economic benefits from aquaculture expansion, may come at the expense of increased and possible unsustainable pressure on ecosystem goods and services (Naylor et al. 2000), ultimately jeopardizing people's food security and livelihoods. Unsustainable use, alteration and transformation of ecosystem services can undermine the productive resource base and divert resources away from other uses and users, bringing aquaculture in conflict with other stakeholders. In addition, benefits derived from aquaculture systems in some cases are steering away from the local communities directly affected by aquaculture, to stakeholders operating on global market scale (e.g. Norway).

When aquaculture started up as an industry in Norway in the late 1960s it was run by small family owned businesses. Many had their experience from fisheries and the fishing industry, and were depending on local resources and facilities for equipment, slaughtering and handling of their products. The industry consisted mainly from local ownership and local employment, providing benefits to the communities where the production plants were located. Since then the industry has grown tremendously, and, in 2010, the export value of the Norwegian aquaculture sector was larger than from the wild harvest fisheries, despite the major fish stocks in the Barents and Norwegian Sea being in very good condition giving large quotas and large catches. Together with the growth in volume for the Norwegian aquaculture industry there has been a quest for cost-efficiency. All sorts of rationalizing measures have taken place, bringing with them specialization, mechanization and automation, centralization of many functions including slaughtering, and also ownership concentration. A major consequence for the communities and municipalities along the Norwegian coast is that the benefits from aquaculture production are very unevenly distributed. Where there previously could be several slaughteries in a municipality there is now typically one shared between many municipalities, with highly mechanized well-boats bringing fish from the different aquaculture-plants to the slaughtery. The care-taker often lives on the site of the aquaculture plant, and may well commute from another municipality or region. Sales-organisations, and all the support they require, is typically centralised with just one office per company. The industry is dominated by large corporations each having a large number of aquaculture licenses and pens, and being registered shareholding companies. The end-result from the local coastal community viewpoint is that aquaculture either gives fairly large benefits to the local community and municipality, or it gives virtually nothing. It is then no surprise that some municipalities have tried to reserve themselves, through their coastal zone area-planning, against having new aquaculture plants in their waters, and especially so if they are not locally owned. The state has considered giving the municipalities more benefits from having aquaculture plants, through an area-tax, but has decided against this. Instead they have allowed the municipalities the right to levy a property tax on aquaculture production facilities, but it seems the municipalities feel this is too small, and much smaller than the area-tax they had hoped for. The Minister of fisheries and coastal affairs has asked that the aquaculture industry make sure local communities get benefits from aquaculture production in their areas. Climate change and some environmental problems may lead to a large re-localisation of aquaculture plants from South to North in Norway. If the municipalities in Norway, who are responsible for coastal zone planning, do not want aquaculture plants in their waters it could cause trouble for the industry and possibly limit national value creation from it. So far the state has generally not allowed municipalities to prohibit or severely limit aquaculture in their waters, having overruled municipal attempts to do so.

The question is how to balance the negative and positive socio-economic consequences from aquaculture development. The landscape and seascape are today increasingly managed for multiple functions and services in addition to provision of food, and this requires the integration of ecological and socioeconomic research, policy innovation, and public education. This dilemma has driven many researchers, experts, NGOs and policy makers to try to address issues related to the sustainability of aquaculture development from disciplinary/sectoral perspectives. However, disciplinary barriers and the lack of awareness of other, related initiatives and developments are rarely overcome. This can result in the pursuit of many individual lines of investigation, without the benefits associated with a more integrated and holistic understanding. Aquaculture development raises questions that cannot be addressed in isolation. If it is to bring about expected benefits, not only to local populations in producing countries outside EU, but also to consumers in Europe and other developed nations, aquaculture development would depend upon the early, and coordinated, tackling of the multiple issues that underpin its interactions and functioning within wider ecosystem, social, economic and political contexts.

Thus, aquaculture appropriates, but can also provide, a range of services as determined by factors such as location of production site, targeted species, production system, market structure and social context. A critical question is how to best guide the development of aquaculture that has the potential to support a portfolio of sustainable livelihoods and assist in poverty alleviation and food security. Aquaculture needs to be analyzed from an ecosystem service (ES) perspective. Additionally, life cycle analysis (LCA) can be used as a tool for identification of linkages to ES and to define appropriate system boundaries. This information will enable a deeper understanding of connections between farming and resource systems being relevant from a livelihood and poverty perspective. Broader systematic perspectives on aquaculture, such as the "Ecosystem Approach to Aquaculture" (Soto et al. 2008) may also enable analysis of trade-offs and sustainability aspects, especially with respect to net benefits for poorer resource users.

A key success factor for effective coordination and fostering synergies that make an impact on how proposed project outputs can aid targeted end-users is the ability to engage all stakeholders at the out start. Thus, participation and good governance are fundamental to the sustainability of aquaculture development. Trust and buy-in generated through grassroot participation and the application of transparent decision-making processes are also the building blocks behind improved coordination of all the sector's stakeholders. Strengthening of institutional capacity and resources (including human capacity), both at national and international levels, are needed for enabling development of aquaculture for poverty reduction and improved human well-being.

4 Review progress on how to evaluate the direct and indirect socioeconomic consequences of the use of space by aquaculture. (ToR a)

4.1 Background

Aquaculture can offer employment and income earning opportunities to local, often rural and marginal, communities. However, questions pertaining to social site-selection criteria, community impacts, right of access, ownership, taxation, liabilities of the negative repercussions from the environmental effects on society, ethical issues, to name but a few, have remained largely untackled in a comprehensive, integrated manner. Each of these issues follows particular interests, priorities and objectives. All operate within an array of federal, regional and international legislations, agreements and treaties. Practitioners note that sustainable aquaculture must not only maximize benefits, but also minimize accumulation of detriments, as well as other types of negative impacts on natural and social environment. Aquaculture is in this case maybe not so different from other economic initiatives that depend on, and impact on, natural resources and social fabric.

Thus, ToR a aims to review progress on how to evaluate direct and indirect socio-economic consequences of aquaculture. This should include the assessment of social site selection criteria, community impacts, right of access, ownership etc. For instance, the FAO Fisheries Report No. 861 of 2008 evaluated a former assessment of socio-economic aspects of aquaculture. The evaluators in particular ask called to "Develop perspectives from institutional economics (particularly new institutional economics) on the problem of aquaculture impact assessment)", page 7, point xi.

These demands could be met by applying an Ecosystem Approach to Aquaculture (EAA). The EAA has been defined as "a strategy for the integration of the activity within the wider ecosystem in such a way that it promotes sustainable development, equity, and resilience of interlinked social and ecological systems" (Soto et al. 2008). According to GESAMP (2008), an ecosystem approach strives to balance diverse societal objectives. Although sustainability may be widely understood in general terms, it is a concept that varies considerably at the operational level. Among others, the key characteristics, challenges, priority objectives, threats, and implementation capacities associated with different social-ecological systems will strongly influence how sustainability may be defined and achieved. In this context, scientific assessments of aquaculture scenarios designed to support the achievement of sustainability should be adaptable to complex, varied social-ecological systems and to multiple spatial scales (e.g. see figure 2 in ToR c). In addition, they should be amenable to the incorporation of multiple, interdisciplinary scientific tools and data.

Significant progress has been made towards evaluating the socio-economic and, perhaps even more, the ecological impacts of aquaculture. A wide range of data and tools have been obtained and developed with a view to achieving sustainability objectives, although less progress has been made towards utilizing this information to influence management decisions. In addition, approaches to evaluating aquaculture often to not take an interdisciplinary approach, which is necessary to capture the complexity of aquaculture scenarios.

In order to address these needs, the SGSA has developed a preliminary **framework for an integrated assessment of the socio-economic dimensions of aquaculture**, shown in Figure 1. Although the focus of the SGSA is socio-economic, the group recognizes the importance of adopting an integrated approach that emphasises the interrelationship between the human and ecological dimensions of aquaculture, i.e. the socio-ecological perspective. The proposed framework is designed to make best use of existing data and scientific tools, some of which are highlighted in the following sub-sections, with a view to ensuring the most efficient use of science for decision-making. The framework is applicable to multiple spatial scales, ranging from individual farms to addressing global impacts. Scale is not viewed as a dimension that can be pre-determined, rather, it is a dynamic characteristic of the social-ecological system which will be defined by the aquaculture scenario and key variables identified in the assessment stage (e.g. the impacts of the accumulation of organic material on the benthic habitats below a cage will be mainly localized whereas the impacts of sales on international markets will have a global scope).

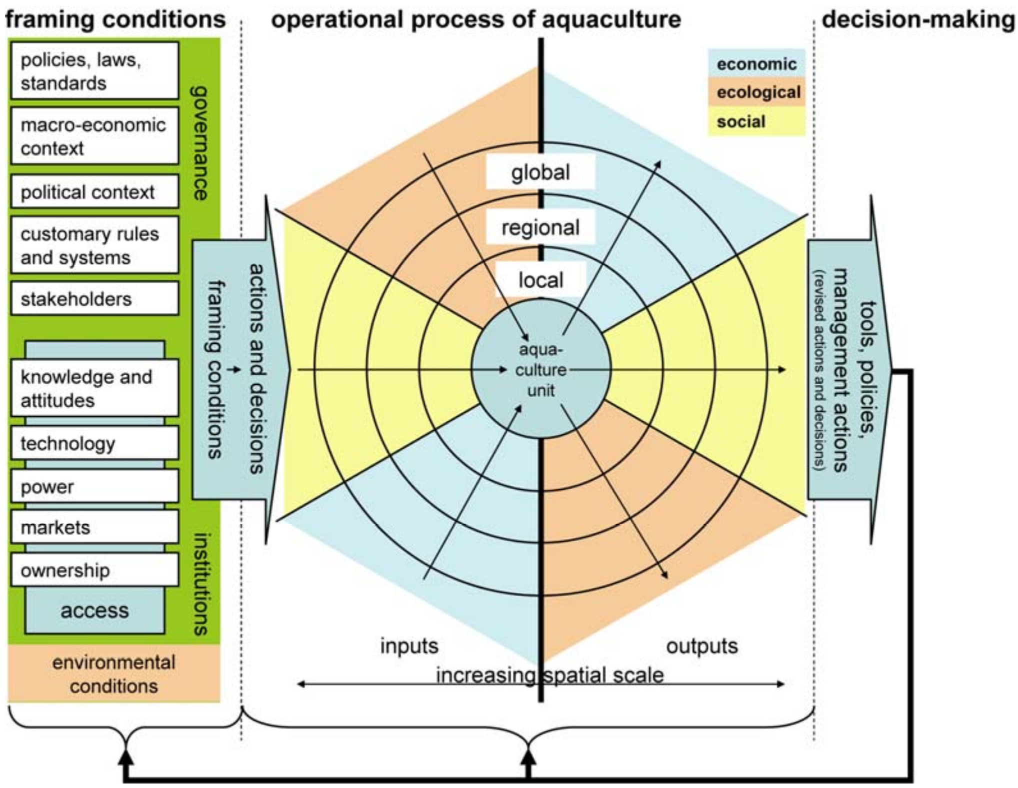

Figure 1. Framework for an integrated assessment of the socio-economic dimensions of aquaculture in three stages: Analysis of the operational processes of aquaculture, of framing conditions, and, subsequently, decision-making.

The framework for an integrated assessment of the socio-economic dimensions of aquaculture consists of a three interrelated, iterative stages: Analysis of the operational processes of aquaculture, of framing conditions, and, subsequently, decision-making. The major objective of these stages, which are intended to be developed further in subsequent meetings of the SGSA and with input from other ICES working groups, are outlined in the following paragraphs. Next, guidance is provided on the specific information needs and scientific tools that may be used to support each of these stages. Although the stages are described as steps in the process, it is important to note that, in many cases, associated analyses and actions will need to be carried out concurrently and iteratively, where information from one feeds into and influences the development of the other.

First, in the **assessment of the operational processes of aquaculture** (the central core of figure 1), indicators and data should be identified and obtained to evaluate the interrelated social, economic and ecological dimensions, or impacts, of the aquaculture unit. The proposed framework categorizes variables as inputs or outputs. Although the specific interpretation of input and output may vary among disciplines, generally, inputs are considered to be resources (human, natural, economic) that are consumed, utilized or transformed as a result of aquaculture activity, where outputs are products and services that are produced or transformed as a result of aquaculture activity.

Second, the **framing conditions** (the left hand column of figure 1), relevant information should be compiled to define the characteristics of the social-ecological system that influence the intensity and tendencies of the impacts and variables identified in the assessment of the operational process of aquaculture. The assessment of the operational process of aquaculture should result in the identification of impacts or related variable that may be impeding the achievement of sustainability objectives, where the framing condition stage should highlight the characteristics of the social-ecological system that influence, or drive, these phenomena. This information can then be utilized in the third **decision-making stage** (right side of figure 1). This stage should propose potential management actions for minimizing negative impacts and maximizing the benefits of aquaculture taking into account the local capacity to implement those actions. This framework is cyclical and iterative, thus supporting an adaptive management approach. Proposed management actions may have short-term or long-term effects on the framing conditions and/or the variables identified in the assessment stage which, in turn, will result in adapted management actions and so on. In this context, monitoring will be an important component of this framework.

It is important to note that a participative approach is integral to all stages of the framework. Although it is evident that scientists will play a more active role in the scoping and assessment stages of the framework and decision-makers in the final stage, iterative communication between them is critical throughout the process in order to ensure the effective integration of science with decision making. Additionally, key stakeholders identified in the scoping stage will play a critical role in shaping, informing and implementing the process[1].

Tools and information needs to support the Framework for an Integrated Assessment of the Socio-economic Dimensions of Aquaculture

The various stages of the proposed framework are dependent upon different, although sometimes overlapping, scientific tools and data. The following paragraphs are intended to highlight some of the tools and data that may be used in these stages. At this stage, potential supporting tools are only listed and not described or evaluated. A future focus of the SGSA could be to evaluate a selection of these tools in more detail. At the end of this section, a hypothetical example of the data needed for the assessment stage of the framework is provided using direct employment in aquaculture as an example (see box 1).

a) Assessment of the operational process of aquaculture

As mentioned previously, the assessment stage consists of the identification and evaluation of indicators and data related to the social, economic and ecological dimensions, or impacts, of the aquaculture unit. This analysis is intended to be interdisciplinary and integrated, where crossover effects among the different systems/scales are taken into account (see box 1). However, there are specific perspectives, data, and tools that will relate to each of the dimensions, which are described in more detail in the following subsections.

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[1] See ToR b for a more detailed discussion of the potentialities for identifying and strengthening local stakeholder inclusion and local ownership in the aquaculture production chain.

Economic aspects

A core problem associated with the assessment of the socio-economic aspects of aquaculture is to compare and balance the different dimensions of the system. For instance, if an aquaculture business pollutes the local environment more than another but brings more income to local stakeholders, it remains a societal decision as to whether which business would be assessed as being "better". Economists would prefer to compare all of these dimensions by valuing them and simply comparing monetary numbers, e.g. by Cost-Benefit-Analysis (C-B-A). However, as markets are not always ideal and there are frequent external effects, economists and other scientists are often faced with severe methodological problems. Of course, valuation of non-market goods and services can be undertaken, e.g. by calculation of costs of avoiding negative external effects (pollution) or by calculating opportunity costs of non-market resources. Another method is to ask for peoples "willingness to pay" in order to value goods and services, e.g. the beauty of a landscape is then valued by asking people how much they are willing to pay to have this landscape unchanged. But the methodological problems remain serious. For example, are all alternative uses of a non-market resource known and valuable, so that the use with the highest value can be taken as opportunity cost? Is measurement of "willingness to pay" biased due to strategic behavior of agents? Another dimension to this is our incomplete understanding of how ecological systems work, i.e. complexity, non-linear responses and thresholds that can bring surprises and difficulties for restoration work. For example the role of biodiversity for ecosystem services is still something that we just are beginning to understand (http://www.teebweb.org).

An example of assessing the direct and indirect economic dimension of an aquaculture business

Think about a single aquaculture enterprise. The site selection must be done, decisions about the organization of the farm have to be taken (including make or buy decisions and ownership structure), the species to be cultured has to be specified, workers must be hired and eventually trained, machines have to be bought or leased, feed sources must be identified and maybe feed has to be bought. Markets have to be identified and the accessibility must be evaluated and maybe secured. Land facilities have to be constructed, cages and nets have to be bought, etc. Finally, fish or other aquaculture products are produced and sold and by-products such as polluted water and other unwanted goods can be observed as a result of this production process. Income, profit and rents flow to the respective persons as income, being a direct consequence of aquaculture production. Goods and services purchased for the production also generates income in other sectors and taxes and fees maybe flow to the state authority. Spending the income manifests as demand in the retail sector, which is another measurable impact. These monetary flows can be easily observed (assuming the shadow economy is not too big) and direct and indirect impacts (by Leontief-Coefficients) can be measured by e.g. using input-output tables, having in mind the restriction of this method. It can also be used to analyze forward and backward linkages. This means to measure the strength and direction in which different sectors of an economy are interconnected and hence rely on each other. The impact of output (including intermediates) uses along the different stages of the production chain is named forward linkage, the impact of the purchase of inputs is called backward linkage.

These actions and decisions have impact on different stakeholders at different levels. Are the workers hired locally and trained, so that their skills are improved and the quality of the local workforce is improved? Does this have an impact on values and attitudes in this community? Alternatively workers may be hired from a different region and the local community is faced with migration problems. Is the profit transferred to a foreign country or is it available and maybe spend on a local or regional level? Is the land facility constructed by local companies or global firms? Does the aquaculture unit purchase its intermediate consumption from the local market or from the global market? What about the extent of the pollution of water or other ecologic dimensions like felling trees to get better access to the plant? This could have different impacts on the acceptance of the aquaculture operation, on the local solidarity, the social peace etc; but how to assess all this in monetary terms? An example of general aquaculture impacts can be found in FAO 2008, pp. 15-22.

Cost-Benefit analysis (CBA) aims to monetarize all these issues. As pointed out in the former paragraph, it is problematic and that is why additional methods have been developed. They are briefly described in the following paragraph. In general one has to have in mind that not all factors can be substituted by others easily or maybe not at all.

More tools and methods to assess preferability of socio-economic benefits

If impacts are incommensurable, CBA cannot be applied anymore. Methods like multiple criteria decision-making (MCDM) or multi-attributes decision-making (MADM) are possible ways to solve the problem. While multiple attribute utility theory (MAUT) is a MADM method which specifies utility functions to describe stakeholders' preferences, Analytical hierarchy process (AHP) does not attempt this. Instead, AHP uses a series of pair-wise comparisons to elicit stakeholders' preferences. It remains unclear whether the use of this more stakeholder oriented methods are practical useful and if the costs are justifiable when multiple stakeholders can be found on local, regional and global levels.

Easy to adapt methods – an example

By analyzing the output of an aquaculture farm in terms of sustainability, one aspect could be the eco-efficiency, i.e. the resources used to produce a certain amount of a product. An indicator could be the Food Conversion Ratio (FCR) or the Biomass harvested per kilo/number of fingerlings. Similar farms in terms of species and environmental conditions could be compared in a benchmarking process and best-practices could be shared. This may be a very cost-effective and pragmatic way to improve a business e.g. in terms of sustainability. The knowledge and service could and maybe should be done by independent scientists.

If someone is interested in economic efficiency, classical indicators for production efficiency and profitability could be applied: Net yield, growth rate, net farm income, rate of return on assets, rate of return on equity, return of labor etc. Here benchmarking is also an appropriate method to find best-practice examples. A possible obstacle to apply this method may be confidentiality reasons.

Link to new institutional economics approach

New institutional economics tools can be applied on all levels of this framework. Principal-agent theory, transaction-costs economics, property rights economics, new political economy and constitutional economics, the two latter ones especially on the macro-level.

Social aspects

In general, many past approaches to ecosystem management might be called "socially illiterate" (Glaser 2006a). Even if beyond reproach in ecological terms, many ecosystem management proposals can be outright failures due to a lack of stakeholder participation and/or understanding of social influences on ecosystems and of ecosystems on humans and society. Most interpretations of the social dimension of ecosystem management are also highly context-specific and lack universal core and general applicability. This makes the issue of a general strategy for sustainable aquaculture operations which takes the social dimension into account so difficult.

More often than not, aquaculture in Europe is faced with increased social conflicts between stakeholders (farmers, nature conservationists, recreation, fisheries). In the Netherlands for example, the use of mussel seed capture systems is promoted as an alternative for bottom dredging. But the supports of the capture systems are floating on the water surface that affects the landscape and the space for recreation and fisheries. These types of interactions and surfacing conflicts underline the importance of including the social dimensions of aquaculture. Decision-making, planning tools and alternative solutions need to be reviewed. How can we evaluate the cross-cutting effects of new established aquaculture facilities? What are indicators of the status of social perception of aquaculture that can help in avoiding conflicts? How do social values and administrative organizations in different countries/regions affect trends in the intensity, methodology, structure and type of aquaculture?

Thus, in a planning perspective, next to the issue of siting, and monitoring of any kind of activities in the coastal and marine waters, an issue not yet being addressed in depth pertains to the social dimension of resource use. The systematic description of the social elements relevant to the sustainable management of marine ecosystems is still in its infancy (IUCN 2001; Lass and Reusswig 2001; Glaser 2006b). However, many socio-economic variables related to aquaculture can be "broken down" into a complex series of "second tier variables" (e.g. Ostrom et al. 2007) which relate to their interrelationship with different parts of the social-ecological system. For example, employment is more than just the number of people employed. It can be directly or indirectly related to, among others, improvements in quality of life, immigration, demographics, consumption of natural resources, etc. Future research should focus on methods for incorporating such complexity and interdisciplinarity into aquaculture assessments.

The lack of a systematic decription of the social dimensions of sustainable management has surfaced prominently in the current ongoing debate on new forms of marine spatial planning. Although international maritime policies (e.g. Canadian *Oceans Act* and EU *Water Framework* and *Marine Strategy Directives*) include essential components; 1) a knowledge-based approach for decision making, and 2) an ecosystem-based approach for integrative management, a shortage is visible of the mostly environmentally motivated approaches to recognise the social functions of nature. Still now, making nature a commodity remains a moral problem even in a market-driven economy (McCay 1998). Questions on who decides what and when as well as ownership issues remain unanswered. For instance for the latter, the large-scale aquaculture developments in Norway have triggered a debate on who decides on the future of the sea and what criteria are used to take such decisions.

As an example, drawing on the experiences made with shellfish cultivation in several places within the ICES scope, unresolved issues of ownership in terms of process, which stakeholders are involved in the consent procedure and their relative influence appear to crucial. Social dimensions in aquaculture operations, e.g. emotional ownership of the sea/coastal area by the local residents/stakeholders and the social values that drive this ownership are difficult to capture. However, precisely these stakeholders and their supporting values are not included in the decision-making process (ICES WGMASC 2010). Next it remains difficult to keep all stakeholders in agreement on the matter—the "contracting costs" (the cost, not necessarily in money, of getting a group of people to agree on an issue) that make it so difficult to enact major institutional change that affects natural resources and their use (McCay 1998).

Ecological aspects

Coastal aquaculture depends on the state of marine environment and influence the environment significantly.

Many studies about aggregated affects at the ecosystem level have been carried out so far (e.g. FAO 2007; GESAMP 2008), depending on the cultivated species, site and production system. Common effects of aquaculture practices on the especially coastal ecosystem may include changes of water quality and eutrophication, changes in aquatic biodiversity including natural fish and shellfish stocks, nutrient and organic enrichment of recipient waters resulting in an increase of anoxic sediments. Further risks are connected to the combined effect of temperature and salinity changes caused by climate warming. Related effects are e.g. changes in production and seasonality processes in plankton and fish populations, introduction of invasive species and the increasing acidity (decreasing pH) of the world's oceans (FAO 2010).

Looking to the quality of aquaculture products environmental conditions such as food availability, food quality and water quality are important input factors as well.

The framework for an ecosystem approach to aquaculture (EAA) was proposed to minimize negative ecological impacts and to ensure a long-term aquaculture production. One of the principles aiming to enhance aquaculture contribution to sustainable development is to develop aquaculture "in the context of ecosystem functions and services with no degradation of these beyond their resilience capacity" (Soto et al. 2008). A further milestone in sustainable aquaculture production is the implementation of rules for organic aquaculture on EU level ((EC) 710/2009). It bases on organically produced feeds and should minimize risks for environmental impacts by e.g. density limits and provisions for optimal feeding.

Important tools to analyze dimensions of conditions and impacts of aquaculture the following methods can be used: environmental impact assessment (local, regional scale), life cycle framework (local to global scale), and benefit-cost approach (local to global scale).

b) Framing conditions stage

As discussed in more detail under ToR c of this report and previously in this section, there are a number of characteristics, or framing conditions, of the social ecological-system that are likely to influence various elements related to sustainability of the aquaculture scenario that is being managed. It is important to identify these characteristics to better understand how and why they influence the system and, conversely, to ensure the tools, policies and actions that are proposed to address impacts are relevant and practical at the societal level. Specifically, as shown on the left side of figure 1, these include: Policies, laws and standards; macro-economic context; political context; customary rules and systems; stakeholders; knowledge and attitudes; technology; power; markets; and ownership. Access, particularly as it relates to knowledge, technology, and markets is also an important element of the framing conditions. In these contexts, access is also related to power and ownership in the aquaculture scenario. Finally, the environmental preconditions (space, habitats, state, protection measures, etc.) will also influence the aquaculture scenario.

Essentially, the framing conditions are constituted by the "rules of the game" and consist of social, economic, political, technological, legal and environmental components. Given this framework, actions and decisions at the micro-level take place at the business level, where the input of resources is transformed into outputs of the aquaculture unit. Inputs and outputs can have direct and indirect impacts on different spatial scales (local, regional and global) as well as on different dimensions of the system, since there are social, economic and ecological dimensions to be taken into account and with respect to different stakeholders as well. The stakeholder dimension could be thought to be a third dimension of the diagram and is not shown to reduce the complexity of the figure.

Methods

Recognition of the growing importance of aquaculture and the need to improve its socio-economic benefits has resulted in various targeted studies, among them different FAO driven initiatives. The Committee on Fisheries (COFI) Sub-Committee on Aquaculture repeatedly has been arguing for the needs for broader thematic evaluation of the social and economic impacts of aquaculture (i.e Trondheim 2003, New Delhi 2006, Rome 2007). The intersession in Turkey 2008, "Expert Consultation on the Assessment of Socio-economic Impacts of Aquaculture" aimed to agree on methodologies for assessing socio-economic impacts of aquaculture and to determine future needs for socio-economic analyses, socio-economic assessments and indicators (FAO 2008). The main conclusion from this meeting was that the many impacts from aquaculture activities have profound interdependence and far-reaching socio-economic implications, something that makes any assessment difficult. Even if consensus was reached amongst the experts over that multiple criteria decision-making (MCDM) framework using analytical hierarchy process (AHP) would be suitable techniques for assessing socio-economic impacts, they also acknowledged that there is no single method which could be used to assess the socio-economic impacts of aquaculture. In addition to MCDM using AHP, "costs benefits analysis" (CBA) was also identified as suitable method. Recommendations from the meeting involved the need for proper testing of the identified methods, developing user guides on the implementation of the methods and building capacity in developing countries for implementing and using the techniques.

In addition, the report "Commercial aquaculture and economic growth, poverty alleviation and food security" (FAO 2009) aimed at providing policy-makers with the necessary tools suitable for quantitative appraisal of the impact of aquaculture. "Aquaculture value-added multiplier" and "aquaculture employment multiplier" (calculated analogue to Leontief multipliers) were suggested as examples for appropriate indicators for representing the increase in gross domestic product corresponding to a one-unit increase in aquaculture value-added and total employment for the entire economy corresponding to one extra job created in aquaculture.

c) Decision-making

The appropriate and efficient use of scientific information for decision-making has been recognized as a significant challenge to the achievement of sustainability of coastal and marine ecosystems (Lubchenco and Sutley 2010; Perrings et al. 2011). The specific objective of this stage is to use the results of the previous two stages to develop policy tools and recommendations for actions to support operational processes of aquaculture for the achievement of sustainability. Essentially, this stage denotes the integration of science into decision-making. Proposed management actions may have short-term or long-term effects on the aquaculture conditions and be implemented by actors on different scales. Monitoring will be necessary to track the impacts of proposed actions and adapt them accordingly to continue to progress towards desired objectives (i.e. an adaptive management approach).

As mentioned previously, although scientists will play a dominant role in the previous stages of the framework and decision-makers in this final stage, collaboration between scientific and social actors is critical throughout the process in order to ensure its overall effectiveness in addressing sustainability problems. The role of key stakeholders and potential ways for including them is discussed in more detail in ToR b.

Supporting tools for the decision-making stage

A number of integrated management frameworks have been developed and implemented in ICES countries that are aimed towards the incorporation of interdisciplinary scientific data and multiple stakeholders into decision-making and policy development. These include Marine Spatial Planning (Ehler and Douvere 2009) and Integrated Coastal Zone Management (Cicin-Sain and Knecht 1998). These frameworks are complementary, and in many ways similar, to the framework proposed in Figure 1. In particular, the approaches applied in MSP and ICZM could help to ensure the effective use of the information generated in stages 1 and 2 for developing realistic, effective decision-making actions in the third stage.

Showcase example to test developed framework

Box 1. Worked Example: Analysis of the inputs and outputs of aquaculture projects and the spatial scales on which they act

Building upon the schematic framework for integrated assessment of the socio-economic dimensions of aquaculture, the tables below (1 and 2) are meant to:

- - show and disentangle the complex nature of the social, economic and ecological dimensions related to aquaculture
- - provide a guideline for an analysis of the framing conditions and the inputs and outputs of aquaculture (i.e. the assessment of the operational stage) and for the development of appropriate management tools and responses to rectify negative impacts and steer aquaculture development onto a desirable path

The FAO Fisheries Report No. 861 (FAO 2008) provides a good framework, guidelines and tools for the assessment of socio-economic impacts of aquaculture. It can thus serve as an appropriate point of departure for assessment. However, it was felt that this basis should be expanded to include:

- - more detailed analysis of the actual inputs and outputs of aquaculture
- - explicit acknowledgement of the social, economic and ecological dimensions involved
- - assessment of the spatial scales at which the variables act
- - thorough assessment of the socio-economic framing conditions under which aquaculture projects are developed and implemented
- - development of management tools and policies to address the identified impacts and to reach the stated objectives of a given aquaculture project, e.g. improved human well-being and food security.

As a first step of an exemplary analysis of a generic aquaculture project, a list of different aspects of the aquaculture project was compiled (Table 1, building upon Tab. 2 in FAO 2008). The aspects were divided into input and output variables and assigned to either the social, ecological, or economic dimension[2]. For the rationale behind the division into input and output variables, see the introduction of chapter 4.1. For each aspect, the most important respective framing conditions were identified. The identification of framing conditions helps in a more holistic site selection and feasibility assessment, which up to date mostly involves ecological, and to a lesser extent economic, considerations.

For each aspect, the scale on which it acts is identified. Most aspects directly translate into impacts resulting from aquaculture (such as pathogen release or generation of employment opportunities). Following from the listing of the various impacts, specific tools or management options to address these impacts can be developed.

Most of the broader aspects of aquaculture and other social ecological scenarios can be disaggregated into more detailed lower-level and secondary aspects (Ostrom et al. 2007). For example, the aspect of employment contains finer aspects such as demographic dimensions, links to job satisfaction, associated labour costs, and so on. Disaggregating the first-tier aspects in this way allows accounting for the complex upstream and downstream linkages associated with aquaculture operations, provides flexibility to accommodate a wide range of case examples, and gives a more detailed view of the involved scales at which impacts occur. Table 2 shows an example of the second-tier aspects associated to Direct Employment.

The analysis of input and output variables and an assessment of the resulting impacts of aquaculture (using Fig. 1 and Tables 1 and 2) allow for an evaluation of desirable and undesirable outcomes. Where undesirable outcomes are identified, the framing conditions resulting in these outcomes can then be assessed in more detail.

Table 1: Overview of different first-tier input and output variables for aquaculture.

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[2] In some cases, the distinction between social and economic aspects is somewhat difficult and not clear-cut.

Dimension	Framing conditions	Input variables	Output variables	Scale	Tools/management options
Social	Labor laws and labor markets	Labor			
	Labor laws and labor markets		Employment (direct and indirect)		
	Distribution, markets		Supply of food		
	Existing infrastructure and social services		Resulting infrastructure and social services		
	Existing education and training		Resulting education and training		
	Existing population and demography		Resulting population and demography		
			Social order		
			Health		
			Leisure		
			Family relations		
			Social interactions		
ecological		Land			
		Water			
		Seed			
		Feed			
			Antibiotics		
			Pathogens		
			Nutrients		
			Aquaculture product		
			Change in pressure on wild stock		
economic		Financial resources			
		Equipment and material infrastructure			
			Income		
			Tax revenue		

The impact of each factor should be assessed e.g. following the methodology of FAO 2008, FAO 2009 (AHP, comparative advantage assessment) and the net benefits and costs weighed. This should include a scale dimension to assess what kinds of impacts occur on which level (e.g. local net benefits vs. regional net losses).

Table 2: Second-tier variables related to a particular aspect of aquaculture, using Direct Employment as example.

Dimension	Framing conditions	Input variables	Output variables	Scale	Tools/management options
Social	Willingness and capacity to engage	Number of people employed		Local	
	Social security				
			Proportion of local population employed	Local	
			Change in crime rate	Local	
			Change in spiritual utility / mental health	Local - ?	
			Demographic dimensions of employment	Local - ?	
			Immigration rate	Local	
			Change in number of skilled people	Local – regional (?)	
			Change in job satisfaction	Local	
ecological	Natural potential for aquaculture	Natural resources to feed workers		Local	
			Change in demand for wild resources	Local – global	
economic	Labor market	Owner: salary		Local	
		Quantity and quality of workforce		Local - ?	
		Secondary costs of labor (e.g. transport)		Local	
			Worker: salary	Local	
			Change in purchasing power	Local – regional (?)	
			Change in skill of work force	Local - ?	

4.2 Recommendation

The SGSA recommends to continue ToR a to review progress on how to evaluate the direct and indirect socioeconomic consequences of the use of space by aquaculture and related science advisory needs for maintaining the sustainability of living marine resources. In more detail, the following issues were identified to be of high relevance to this ToR:

- A clear definition, early on in the assessment process, of the socio-economic and ecological objectives associated with aquaculture operations e.g. improved human well-being and food security.

- Explicit acknowledgement of the complex, interrelated social, economic and ecological dimensions of aquaculture operations. Specifically, this should include:
  - Direct and indirect impacts associated with aquaculture operations;
  - Socio-economic and environmental framing conditions under which aquaculture projects are developed and implemented;
  - Detailed analysis of the inputs and outputs of aquaculture, which includes an assessment of the spatial scales at which the variables act;
  - Stronger consideration of the distribution of benefits (related to inputs and outputs), including the distribution of "burdens" throughout the social-ecological system. Specifically, this dimension addresses questions about *who* is benefiting (or losing) and to what extent (i.e. employment, wages, improved quality of life) and the geographical distribution and of these benefits (e.g. is the majority remaining in the local population or are the benefits flowing out to international locations?).
- The development of science-based management tools and policies to evaluate, address, and monitor identified impacts and additional elements highlighted in the previous recommendation and to achieve the stated objectives of a given aquaculture project,

4.3 References

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5 Review the potentialities for identifying and strengthening local stakeholder inclusion and local ownership in the aquaculture production chain. (ToR b)

Over the past decades, scientists and policymakers have become increasingly aware of the complex and manifold linkages between ecological and human systems, which generated a strong research effort into social-ecological systems analysis. Social-ecological systems are understood to be complex adaptive systems where social and biophysical agents are interacting at multiple temporal and spatial scales (Janssen and Ostrom 2006). This has stimulated researchers across multiple disciplines to look for new ways of understanding and responding to changes and drivers in both systems and their interactions (Zurek and Henrichs 2007). Integrated coastal zone management (ICZM) can be viewed as being part of this social-ecological system paradigm, in which special emphasis is placed on the complexities of coastal settings and their manifold drivers in ecological and human systems. Both, the social origins of unsustainable ecosystem management and the social repercussions of environmental management are central to these approaches.

Indeed, more often than not, local communities have little political representation with only marginal links to key decision-makers. Drawing on the experiences made with shellfish cultivation in several places within the ICES scope, unresolved issues of ownership in terms of process, and which stakeholders are involved in the consent procedure and their relative influence appear to crucial. For instance, social dimensions of shellfish cultivation operations, e.g. emotional ownership of the sea/coastal area by the local residents/stakeholders and the social values that drive these ownerships are difficult to capture. However, precisely these stakeholders and their supporting values are not included in the decision-making process. Next it remains difficult to keep all stakeholders in agreement on the matter—the "contracting costs" (the cost, not necessarily in money, of getting a group of people to agree on an issue) that make it so difficult to enact major institutional change that affects aquaculture production. Especially in the light of the "industrialisation of the oceans", the balancing of interests of internationally acting aquaculture companies and local effects of these need to be addressed.

Site-selection for aquaculture production sites tends to draw lines on maps and within communities by creating limited access permits and complex management structures. Issues of the access to, and ownership and distribution of the resources are cases where the appropriators of the marine and coastal resources are not being involved in decision making. However, these constructions are contested and negotiated by coastal communities, whose actors developed their own diverse coastal spaces, according to their social practices, economic activities, and environmental perceptions, leading to a much more fragmented coast. This has serious implications, particular spatial distributions of access rights, as in the case of aquaculture production as a potential new stakeholder group in coastal and marine areas.

5.1 Recommendation

This ToR shall be continued in the next year and addressed in more detail. It is recommended to rephrase this ToR to "review the role of local stakeholder inclusion and local ownership in the aquaculture production chain".

5.2 References

Janssen, MA, Ostrom, E (2006). Governing Social-Ecological Systems. In: Handbook of Computational Economics, Vol. 2: 1465-1509 pp.

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6 Address how social values and administrative organisations in different countries/regions affect trends in the intensity, methodology, acceptance, structure and type of aquaculture. (ToR c)

In the development and implementation of aquaculture projects, considerable progress has been made in methods and tools that assess biophysical and economic preconditions, e.g. in terms of site selection. On the other hand, social, cultural or political framing conditions surrounding aquaculture projects are seldom explicitly addressed in planning. As a consequence, the implementation of projects sometimes fails due to factors that could have been foreseen if a more thorough analysis that pays sufficient attention to the socio-economic dimension had been conducted, or implementation results in unexpected and undesirable outcomes (e.g. Thomas 1994).

For example, mariculture is frequently listed as a potential supplementary or alternative livelihood option for fishing communities, yet this activity may not be seen as a desirable or viable option for fisherfolk due e.g. to cultural or economic reasons (Pollnac et al. 2001). Furthermore, rather than reducing their fishing effort as a result of income generated by mariculture, fishers may opt to invest this revenue into fishing gear, thus actually increasing fishing efforts and pressure on wild stocks (Sievanen et al. 2005).

Additionally, while a key rationale for aquaculture development is to strengthen food and economic security of large parts of the population, prevailing policies, incentive and power structures, and distribution of knowledge, technology and ownership may lead to the development of aquaculture projects that produce organisms not consumed or traded locally, and that benefit only a small and specific group of stakeholders (Armitage 2002; Barrett et al. 2002; Belton and Little 2008; Bergquist 2007; Tapia and Zambrano 2003; see Fig. 2).

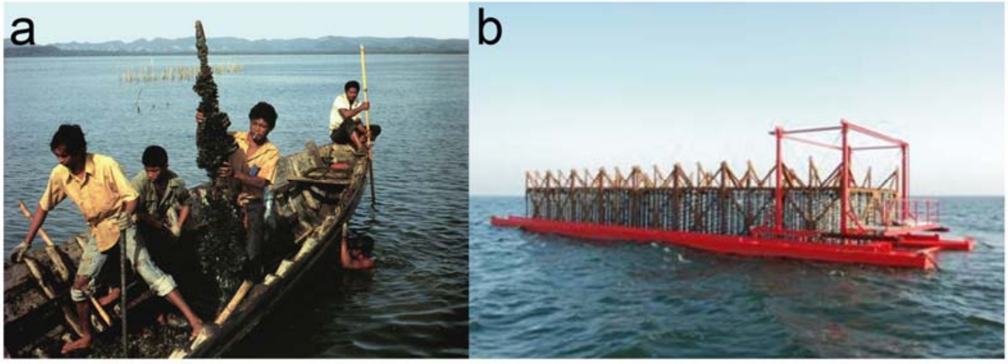

Figure 2: Illustrating the wide range of different socioeconomic dimensions of aquaculture. a) local fishermen harvesting green mussels in Chumporn Bay / Thailand (photograph: Michael Vakily, ICLARM) b) the offshore Reynaert-Versluys pontoon mussel collector (photograph: ILVO, Kris Van Nieuwenhove; WGMASC 2011)

Finally, stakeholders of aquaculture projects encompass a wide range of actors with different and often contrasting views, objectives and capacities (BRS 2004).

Hence, it is argued that a thorough assessment of the framing conditions of aquaculture development that encompasses ecological, economic and social dimensions is crucial to a) improve the successful implementation and b) arrive at more desirable outcomes of aquaculture projects. The point of departure for the analytical process suggested by the study group is an assessment of the input and output variables of aquaculture projects (see ToR a). Here, this assessment is expanded to include the socio-economic framing conditions of aquaculture. For example, a detailed understanding of community characteristics such as level of participation, modes of communication, and demographics, allows for a better analysis of the reasons for success or failure and ultimately for socio-economic outcomes of aquaculture (e.g., Bergquist 2007; Kularatne et al. 2009; Tam 2006).

6.1 Recommendation

- The study group recommends developing/reviewing a methodological framework and tools for the assessment of socio-economic framing conditions. Potentially amenable tools include Rapid Rural Appraisal (RRA), Sustainable Livelihoods Approach (SLA) (e.g. Brugère et al. 2010) and New Institutional Economics (NIE).
- Many aquaculture assessments focus primarily on the impacts of the activity without enough consideration of the framing conditions that are driving those impacts or that influence how the impacts are managed. Understanding the local context (social, political, environmental, economic) is critical to the effective evaluation and management of aquaculture scenarios. This is especially pertinent with respect to socio-economic framing conditions which are often overlooked in scientific studies. SGSA recommends that future research related to aquaculture should place more emphasis on these dimensions.

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7 Identify new emerging issues of socio-economic aspects of aquaculture. (ToR d)

The SGSA identified a number of emerging issues related to the socio-economic aspects of aquaculture that could be addressed by future research. These include:

- Should/can aquaculture serve the growing worldwide demand for seafood products?
- Do aquaculture products affect markets for wild catch fisheries and other food markets and if so, to what extent? E.g. Effects of aquaculture on world fish supplies (Naylor et al., 2000, 2009) and the use of wild fish as aquaculture feed and its effects on income and food for the poor and the undernourished (Wijkström 2009)
- Related to other protein sources, what is the burden of aquaculture production compared to other protein sources (e.g. carbon footprint of aquaculture products compared to beef or poultry)? Is the usage of LCA analysis as a method to address these issues practical?
- Can aquacultured biomass serve as a source for energy production and what does this mean e.g. in ethical terms to not use it as food? How can

science be better integrated into decision-making in order to address socio-economic concerns?

- Is aquaculture a real alternative livelihood options for coastal communities?
- What is the potential of social network analysis tools to address socio-economic issues of aquaculture?

7.1 Recommendation

- Revise the forthcoming Aquaculture Report of STECF (Scientific, Technical and Economic Committee for Fisheries) in order to assess if ICES needs are met or how this could be ensured.
- Revise the underlying EU Data Collection Framework (DCF) Commission Decision 2010/93/EU on Council Regulation (EC) No 199/2008 as well as the Aquaculture Statistic Regulation (REGULATION (EC) No 762/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL) of the EU in order to assess if ICES needs are met or how this could be ensured.

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Annex 2: Agenda

Monday 11 April

18:00 Informal gathering and ice-breaker

Tuesday 12 April

09:00 Welcome Note from the Director of the ZMT, Prof. Dr. Hildegard Westphal

09:10 Housekeeping information from Gesche Krause

09:30 introductory round and adoption of the agenda

10:00 Presentation of 2011 ToRs of SGSA by chair

10:30 Health Break

11:00 Discussion on 2011 ToRs and identification of subjects of mutual interest

- General discussion of ICES activities and Terms of Reference
- Adoption of agenda
- Develop work plan, identify subgroups, subgroup leaders and rapporteurs
- Subgroups:
- ToR a: Progress on evaluating direct and indirect socioeconomic consequences of aquaculture
- ToR b: Identifying and strengthening local stakeholder inclusion and local ownership in the aquaculture production chain
- ToR c: Affects of social values and administrative organizations in different countries/regions on intensity, methodology, acceptance, structure and type of aquaculture

Split up in working groups to discuss how to proceed for remainder of week

12:30 Lunch

13:30 Continue ToR subgroup sessions

15:30 Health Break

16:00 Continue ToR subgroup sessions

17:00-18:00 Plenary update and wrap-up discussions

Wednesday 13 April

09:00 Plenary overview of work status and start of ToR d: Emerging issues of socio-economic aspects of aquaculture

10:30 Health Break

11:00 Reconvene ToR subgroup sessions

12:30 Lunch

13:30 ToR subgroup sessions

15:00 Health Break

15:30 – 17:00 Reconvene ToR subgroup sessions and prepare first drafts

17:00 – 18:00 Plenary discussion and drafting of recommendations

19:00 Dinner at the Schnoor - restaurant "Kaiser Friedrich" (directions attached)

Thursday 14 April

09:00 Plenary discussion on first drafts

10:30 Health Break

11:00 ToR subgroup sessions to revise text

12:30 Lunch

13:30 ToR subgroup sessions to revise text

15:00 Health Break

15:30 -17:00 Plenary Session:

- Review and adoption of the scientific text of the report
- Discussion and drafting of recommendations
- Prepare Executive Summary
- Discussion on possible new Terms of Reference
- Discussion on Theme Sessions for Annual Science Conference in Bergen 2012
- Location and time of next meeting

17:30 -18:00 Meeting Adjournment

Annex 3: SGSA terms of reference for the next meeting

Please use the example below to formulate your draft resolutions for next year's meeting.

The **Study Group on Socio-Economic Dimensions of Aquaculture** (SGSA), chaired by Gesche Krause, Germany, will meet in Stockholm, Sweden, 17–19 April 2012 to:

a) Develop, identify and evaluate methods on how to assess the direct and indirect socio-economic consequences of aquaculture operations and how they relate to an assessment framework.

b) Review the role of local stakeholder inclusion and local ownership in the aquaculture production chain.

c) Address how the socio-economic framing conditions in different countries/regions affect trends in the intensity, methodology, acceptance, structure and type of aquaculture.

d) Identify new emerging issues of socio-economic aspects of aquaculture.

SGSA will report by 31 of May 2012 (via SSGHIE) for the attention of the SCICOM.

Supporting Information

PRIORITY	The new SGSA is of fundamental importance to ICES environmental science and advisory process and addresses many specific issues of the ICES Strategic Plan and the Science Plan. The scope and aims of this group will lead ICES into issues related to the socio-economic effects of the continued rapid development of aquaculture, especially with regard to the implications of changing environmental conditions. Consequently, these activities are considered to have a high priority.

Scientific justification	Term of Reference a) Develop, identify and evaluate methods on how to assess the direct and indirect socio-economic consequences of aquaculture operations and how they relate to the assessment framework. Aquaculture can offer employment and income earning opportunities to local, often rural and marginal, communities. However, questions pertaining to social site-selection criteria, community impacts, right of access, ownership, taxation, liabilities of the negative repercussions from the environmental effects on society, ethical issues, to name but a few, have remained largely untackled in a comprehensive, integrated manner. Each of these issues follows particular interests, priorities and objectives. All operate within an array of federal, regional and international legislations, agreements and treaties. The systematic description of the social elements relevant to the sustainable management of aquaculture in general is still in its infancy. The social repercussions of environmental effects from aquaculture are central here. A clear definition of socio-economic and ecological objectives for all aquaculture operations is necessary which acknowledge the social, economic and ecological dimensions. A stronger consideration of the distribution of benefits (related to inputs and outputs) throughout the social-ecological system is necessary. Specifically, this dimension addresses questions about who is benefiting and to what extent (i.e. employment, wages, improved quality of life) and the geographical distribution and of these benefits. Future research should focus on methods for incorporating such complexity and interdisciplinarity into aquaculture assessments. The assessment framework developed by the SGSA shall be revisited and futher elaborated Term of Reference b) Review the role of local stakeholder inclusion and local ownership in the aquaculture production chain Site-selection for aquaculture production sites tends to draw lines on maps and within communities by creating limited access permits and complex management structures. More often than not, local communities have little political representation with only marginal links to key decision-makers. However, these constructions are contested and negotiated by coastal communities, whose actors developed their own diverse coastal spaces, according to their social practices, economic activities, and environmental perceptions, leading to a much more fragmented coast. Drawing on the experiences made with shellfish cultivation in several places within the ICES scope, unresolved issues of ownership in terms of process, and which stakeholders are involved in the consent procedure and their relative influence appear to crucial. Issues of the access to, and ownership and distribution of the resources are cases where the appropriators of the marine and coastal resources are not being involved in decision making For instance, social dimensions of shellfish cultivation operations, e.g. emotional ownership of the sea/coastal area by the local residents/stakeholders and the social values that drive these ownerships are difficult to capture. However, precisely these stakeholders and their supporting values are not included in the decision-making process. Next it remains difficult to keep all stakeholders in agreement on the matter—the "contracting costs" (the cost, not necessarily in money, of getting a group of people to agree on an issue) that make it so difficult to enact major institutional change that affects aquaculture production. Especially in the light of the "industrialisation of the oceans", the balancing of interests of internationally acting aquaculture companies and local effects of these needs to be addressed. Term of Reference c) Address how the socio-economic framing conditions in different countries/regions affect trends in the intensity, methodology, acceptance, structure and type of aquaculture. To address the social transformations caused by the new technological innovations that competes, and threatens to replace, a capture fishery imbued

Resource requirements	None required other than those provided by the host institute.
Participants	The Group is normally attended by some 10–12 members and guests.
Secretariat facilities	None.
Financial:	No financial implications.
Linkages to advisory committees	SCICOM
Linkages to other committees or groups	WGMASC, WGEIM, WGIZCM, ++
Linkages to other organizations:	The work of this group is aligned with similar work of the World/European Aquaculture Society (WAS/EAS), European Society of Ecological Economics (ESEE), FAO, ++ and numerous scientific and regulatory governmental departments in ICES countries.

Annex 4: Recommendations

Recommendation	For follow up by:
1. The SGSA recommends to continue ToR a to review progress on how to evaluate the direct and indirect socioeconomic consequences of the use of space by aquaculture and related science advisory needs for maintaining the sustainability of living marine resources.	Sci Com, SGSA
2. The SGSA recommends that there should be an explicit acknowledgement of the complex, interrelated social, economic and ecological dimensions of aquaculture operations. These pertain to direct and indirect impacts but alos to the socio-economic and environmental framing conditions under which aquaculture projects are developed and implemented.	Sci Com
3. The SGSA recommends that any detailed analysis of the inputs and outputs of aquaculture, should include an assessment of the spatial scales at which the variables act and the distribution of benefits (related to inputs and outputs).	Sci Com
4. The SGSA recommend to emphasis stronger the development of science-based management tools and policies to evaluate, address, and monitor identified impacts and additional elements highlighted in the previous recommendation and to achieve the stated objectives of a given aquaculture project,.	Sci Com
5. SGSA recommends to rephrase ToR b to "review the role of local stakeholder inclusion and local ownership in the aquaculture production chain". It is recommended to continue this ToR in the next meeting in more detail..	Sci Com, SGSA
6. The SGSA recommends that ToR c remains active to develop/review a methodological framework and tools for the assessment of socio-economic framing conditions for aquaculture.	Sci Com, SGSA
7. The SGSA recommends that understanding the local context (social, political, environmental, economic) is critical to the effective evaluation and management of aquaculture scenarios. This is especially pertinent with respect to socio-economic framing conditions which are often overlooked in scientific studies.The role of faming conditions must be stronger emphasis in future research	Sci Com,
8. SGSA recommends to revise the forthcoming Aquaculture Report of STECF (Scientific, Technical and Economic Committee for Fisheries) in order to assess if ICES needs are met or how this could be ensured.	Sci Com
9. The SGSA recommends to revise the underlying EU Data Collection Framework (DCF) Commission Decision 2010/93/EU on Council Regulation (EC) No 199/2008 as well as the Aquaculture Statistic Regulation (REGULATION (EC) No 762/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL) of the EU in order to assess if ICES needs are met or how this could be ensured.	Sci Com
10. The SGSA recommends to continue ToR d to identify and report on emerging socio-economic issues and related science advisory needs for maintaining the sustainability of living marine resources	Sci Com, SGSA
11. The SGSA recommends that ICES encourages member states for better participation to WGs dealing with aqaculture issues.	Sci Com