GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

COMMISSION GÉNÉRALE DES PÊCHES POUR LA MÉDITERRANÉE

COMMITTEE ON AQUACULTURE (CAQ)

WORKING GROUP ON SUSTAINABILITY INDICATORS (WGSA) INDICATORS FOR SUSTAINABLE DEVELOPMENT OF AQUACULTURE AND GUIDELINES FOR THEIR USE IN THE MEDITERRANEAN (InDAM)

Report on the Turkish Pilot Study (Phase II) for the Selection of a set of indicators for the sustainable development of aquaculture in the Mediterranean

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By

Ferit RAD, Güzel YÜCEL GIER and Hayri DENIZ

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1. INTRODUCTION

1.1 Turkish Marine Aquaculture Sector

Marine fin fish aquaculture in Turkey is mainly concentrated on farming of European sea bass (*Dicentrarchus labrax*) and gilthead sea bream (*Sparus aurata*) along Aegean and Mediterranean coasts. On-growing of portion-sized Rainbow trout (*Oncorhynchus mykiss*) to so-called "Salmon-trout" and production of European sea bass along Black sea coast is also practised.

Thanks to rapid growth of off-shore marine aquaculture along the Aegean, Turkey is the second largest producer of sea bass and sea bream in the Mediterranean. In 2010, production of sea bass (50 796 tonnes) and sea bream (28 157 tonnes) constituted 47% of total aquaculture output which was recorded as 167 141 tonnes. Production of rainbow trout in freshwater was reported as 78 165 tonnes, while 7 079 tonnes of salmon-trout was produced in the Black sea.

There are over 300 marine farms engaged in on-growing of sea bass and sea bream which are mainly located in Muğla and İzmir provinces. On-growing in off-shore cages constitute 90% of production by volume. The remaining 10% comes from land-based farms using earthen ponds and underground brackish/saline water for on-growing purposes. Off-shore cages are generally 16-30 m in diameter and are located at least 0.6 mile from the coast and at a depth of 30 m. There are about 20 operating marine hatcheries producing mainly sea bass, sea bream while other alternative species are also produced on small-scale.

The structure of marine aquaculture industry has been changing in recent in favor of large-scale operations. This is actually the outcome of use of off-shore technology in marine aquaculture. The use of off-shore technology in Turkish marine aquaculture industry has been an obligation due to recent legislation on protection of marine environment which has forced marine farms to move further off-shore. High capital investment required by off-shore facilities is only feasible for high-volume operations where operators can take advantage of scale economy to compensate the huge capital invested in fixed assets and reduce unit production costs. Enterprises lacking the financial means to meet capital requirements of operating off-shore are merged by large-scale operators. The number of enterprises engaged in marine aquaculture is therefore, diminishing while few large-scale vertically integrated enterprises with annual production capacities of over 10 000-15 000 tonnes are emerging as major players in the industry. While farms with annual capacities of 1000-2000 tonnes were considered as large-scale years ago, are now regarded as small to medium-scale operations.

Although domestic consumption of farmed sea bass and sea bream is increasing, Turkish marine aquaculture industry and specifically sea bass farming is still to a great extend export-oriented. Competition in international markets has had a positive impact on Turkish marine aquaculture industry, with respect to increasing production efficiencies, food safety and environmental standards while meeting market requirements. Use of highly mechanized off-shore facilities, modern packaging and processing facilities with high hygienic standards and increasing use of certification schemes at production level are contributing to sustainability of Turkish marine

aquaculture sector. However; as far sustainability is concerned there are still challenges to be met *inter alia* regulating supply in line with demand, price volatilities, increased concentration on supply and marketing side, lack of product diversification and differentiation to create new demand and markets, in appropriate input/output price parities, competition for production sites with other coastal users, increasing pressure and disinformation from mass media on environmental impact of aquaculture, weak producer organizations and lack of collective marketing and market promotion activities.

Monitoring economic, environmental, social and governance dimensions of Turkish marine aquaculture industry using sustainability indicators would therefore, enable producers and policy makers to proactively meet these challenges. In this respect GFCM-CAQ InDAM project has been regarded by Turkey as an important initiative which would contribute to sustainable development of marine aquaculture at Mediterranean level. And Turkey has taken a leading role in implementation of InDAM project by organizing the first pilot action in Muğla in 2009 with support of GFCM Secretariat.

1.2. Background Information on Turkish Pilot Action-II

Development of a sustainable aquaculture industry has been on agenda of GFCM member countries since the establishment of CAQ in 1996. The mandate of CAQ include promoting the sustainable development and responsible management of marine and brackish water aquaculture in the region and providing independent advice on the technical, socio-economic, legal and environmental bases for common standards, norms and guidelines and decisions for consideration by the Commission.

In addressing its mandate for development of sustainable aquaculture and challenges encountered by the industry, Working Group on Sustainability (WGSA), which is one of the three CAQ subsidiary bodies, developed a project titled "*Indicators for Sustainable Development of Aquaculture and Guidelines for their use in the Mediterranean"*- InDAM.

InDAM Project aims to provide GFCM member countries with a comprehensive decision-support tool for the development of sustainable aquaculture based on set of principles, criteria and indicators along with reference points and guidelines adapted to the Mediterranean region. The establishment of a regional reference system for the development of sustainable marine aquaculture in the Mediterranean by intergrading social-economic and environmental aspects into coastal zone management is also among objectives of InDAM project.

Co-construction through workshops with key stakeholders e.g. farmers, NGOs, professional and producers organizations, researchers and decision-makers along with pilot actions and field studies at local level are core methodological elements of indicator development, selection and assessment process adapted by InDAM project. Pilot studies were also aimed to improve communication between farmers and society and to share knowledge and experience at local level.

To this end, the first series of pilot actions were implemented in Muğla/Turkey and Monastir/Tunisia in 2009. Turkish pilot action (*Technical meeting on indicators for the development of sustainable aquaculture in the Mediterranean sea*) aimed to; a) initiate a

quantitative indicator selection process based on identification and prioritization of attributes for selection of indicators by key stakeholders, b) accordingly appraise the initial set of indicators developed by InDAM and c) finally select indicators for implementation at local level. During the two-day technical meeting the initial set of 160 indicators belonging to environmental, economic, social and governance dimensions were reduced to 116 indicators. 41 environmental, 31 economic, 12 social and 32 indicators belonging to governance dimensions were selected for implementation at farm/sectoral level.

A second series of national pilot actions were planned during 4th Coordinating Meeting of the Working Groups (27 Nov., 2010, Malta) and endorsed during 7th Session of CAQ (8-10 March, 2001, Rome) as follow up of pilot studies in Muğla and Monastir (Tunisia). The second step of pilot studies were planned to focus on assessing the selected indicators during phase-I of pilot actions.

Within this context Turkish Pilot Action-II (TPA-II) was designed to assess/test the applicability of selected candidate indicators during phase-I and thereby identify workable set of applicable indicators including methodological sheets outlining definitions, formula/calculation, sources of data and reference values/baselines/standards.

2. TURKISH PILOT ACTION-II

2. 1. **Methodological Framework**

Assessing and refining indicators by focus-group discussions and testing of indicators through field studies were the core elements of methodological approach adapted for TPA-II. The adapted methodological framework can be summarize as following:

1. Preparatory stage included:
   - ✓ Kick-off meeting on methodological and organizational Aspects.
   - ✓ Review of existing literature on development, selection, assessment and implementation of sustainability indicators.
   - ✓ Development of a conceptual and methodological framework for assessment of selected candidate indicators through focus group discussions.
   - ✓ Development of guidelines for focus-group discussions (Appendix-1)
   - ✓ Developing indicator evaluation sheets for discussing and assessing applicability of candidate indicators during focus-group discussions (Appendix-2).
   - ✓ Identification of participants for focus-group discussions

2. Organization of focus-group meeting to:
   - ✓ Review and assess indicator based on evaluation sheets for selected candidate indicators in TPA-I and identify applicable and potentially applicable indicators according to developed guidelines with stakeholders (Appendix-1).
   - ✓ Develop and propose new indicators if any, including methodological aspects.
   - ✓ Discuss and develop reference values/baselines/standards for monitoring of indicators through traffic light approach.

3. Organization of field study to:

- ✓ Further test and validate applicability of indicators at enterprise level e.g. cage and land-based farms, packaging/processing, feed manufacturers, producers.

4. Final Stage included:
- ✓ Reassessment and fine-tuning of indicators including methodological aspects to develop methodology sheets for applicable/potential/new indicators.
- ✓ Preparation of final repot

2.2. Focus-Group Meeting

2.2.1. Opening of the meeting

Focus group meeting was held on 21-22 September 2011 in Muğla. The meeting was attended by 33 invited participants including fish farmers, farm managers, food safety mangers, producers' organization representative, administrators/technocrats and researchers from different disciplines e.g. aquaculture, veterinary sciences, social and admintartive sciences, agricultural economy, environmental sciences, fish nutrition and feeding and fish processing technology. The list of participants is included in Appendix 3.

Mr. Hayri DENIZ, opened the meeting and welcomed the participants on behalf of Ministry of Food, Agriculture and Livestock. He summarized the agenda and thanked the participants for their contributions beforehand. He left the floor to Mr. Ahmet DALLI, the Head of Provincial Directorate of Food, Agriculture and Livestock of Muğla Province. Mr. DALLI, welcomed the participants to Muğla and briefly highlighted the growth of aquaculture in Muğla Province which is regarded as the heart of marine aquaculture in Turkey. He further underlined the support of the Ministry of Food, Agriculture and Livestock for promoting aquaculture in Turkey and Muğla and stressed that aquaculture is providing quality fish to society at an affordable price and further development of aquaculture is inevitable. He regarded sustainable development as the key policy instrument and hoped for fruitful discussions during the meeting.

Mr. Ferit RAD briefed the participants on GFCM subsidiary bodies and affiliated projects and outlined the scope, objectives and activities of InDAM project since 2008. The adapted PCI (Principles, Criteria and Indicators) methodology, co-construction of sustainability indicators with key stakeholders, bottom-up approach and outcomes of Montpelier I and II meetings were summarized. He further highlighted the participants on InDAM activities and pilot actions namely Muğla (Turkey), Monastir (Tunisia), MDIQ (Morocco), Andalucia (Spain) and provided background information on Turkish Pilot Action-I which was implemented in 2009 in Muğla to select the indicators with key stakeholders at local level. He outlined the objectives, adapted conceptual/methodological approach for selection of indicators and summarized the main outputs of Turkish Pilot Action-I.

Following this briefing Ms. Güzel YÜCEL GIER, described the PCIs for the environmental dimension, always relating them to the sustainability of marine aquaculture. Further, she outlined the reasons why the original TPI indicators were reduced in number and how the InDAM project methodology regarding environmental principles, criteria and indicators had been evolved in Montpelier 1 and 2 meetings. She

went on to describe how these should be applied so as to assure the best possible environment-aquaculture interaction. She finally presented the Turkish Pilot Action-I selected indicators.

Mr. Hayri DENIZ, also briefed the participants on main principles, criteria and indicators belonging to social and governance dimensions adapted by InDAM project and summarized the associated selected indicators. The opening session of the meeting was concluded with presentation of Mr. Ferit RAD. He summarized the main principles, criteria and indicators developed by InDAM project and highlighted the participants on outcomes of Turkish Pilot Action-I with regard to selected indicators for economic dimension of sustainable aquaculture.

2.2.2. Arrangements for focus-group discussions

Mr. Ferit RAD, introduced the objectives and foreseen conceptual and methodological framework for focus-group consultations. Stressing that identifying workable/applicable set of indicators with reference values, baselines or standards to guide sustainable development of marine aquaculture will be the core objective and task of focus-group discussions; he welcomed any proposal or recommendations with regard to new indicators. He further stressed that based on developed evaluation sheets, indicators will be assessed according to context and data-specific indicator quality attributes and introduced the guidelines for focus-group discussions (Appendix-1). Participants were then asked to choose and join one of the following focus-groups based on their expertise and interest:

- ✓ Focus-group on environmental indicators, coordinated by Mrs. Güzel YÜCEL GIER,
- ✓ Focus-group on economic indicators, coordinated by Mr. Ferit RAD,
- ✓ Joint focus-group on social and governance indicators, coordinated by Mr. Hayri DENIZ

Following the arrangements of focus-groups; discussions were initiated by presenting the evaluation sheet (Appendix- 2) for each indicator within each dimension by respective coordinators. In the first round of focus-group discussions indicators were evaluated in terms of their context-specific quality attributes and those categorized as "sufficient" were then assessed in terms of data-specific indicator quality attributes in the second round of discussions. Discussions in both rounds continued until a consensus was reached with regard to each indicator. Those indicators categorized as "applicable" or "potentially applicable" in the second round were considered for further testing through field studies.

2.2.3. Outcomes of focus-group discussions

Economic dimension

The focus-group on economic dimension reviewed and discussed an initial set of 31 selected candidate indicators which had obtained an average score of ≥5 points (out of scale of 1-9 points) during Turkish Pilot Action-I (Table 1).

Table 1. Initial set of candidate economic indicators evaluated during focus-group discussions.

Indicator	Rank
Existence of Quality Certification Schemes (Independent Bodies) (Y/N and %)	**1**
Feed Cost/Kg Fish Produced (and % of Total Cost/kg)	**2**
Fry Cost/kg (and % of Total Cost/kg)	**3**
Supply and sales by contract or by market	**4**
Existence of farm health management system (including vaccination program)	**5**
Labor Cost/Kg Fish Produced (and % of Total Cost/kg)	**6**
Existence of a Traceability System	**7**
Energy Cost/Kg Fish Produced (and % of Total Cost/kg)	**8**
Number of National Hatcheries (also % of Fry imported)	**9**
Unit Production Cost (Total Variable and Fixed Costs/Kg Fish Produced/operating costs) (Ex-cage)	**10**
Gross Profit Margin (Gross Profit/Revenue x100)	**11**
Sector Market studies	**12**
Existence of Own-Label (Y/N and %)	**13**
Duration of Lease of the Site	**14**
Transportation Cost/kg (and % of Total Cost/kg)	**15**
Market Data Dissemination (Annual Seminars by Federations or Authorities)	**16**
Sector Market studies	**17**
Number of Products (i.e. Species, Size Categories, Value-added)	**18**
Percentage of value-added products	**19**
Existence of Producer's Organizations or Cooperatives for Sales	**20**
Financial Costs/Kg Fish Produced (and % of Total Cost/kg)	**21**
Availability of Processing Capacity for the Sector	**22**
Rate of Return on Farm Assets	**23**
Existence of National Legislation for Zoning	**24**
Existence of Training Program for Sector Employees on Environmental Aspects of Activity	**25**
Existence of Legislation for Monitoring of Environmental Parameters	**26**
Existence of Training Program for Sector Employees on Financial Aspects of Activity	**27**
Debt/Equity Ratio (Total Farm Liabilities/Total Farm Equity)	**28**
Integration of Core Business with Complementary Activities (Eco-tourism, Recreational fishing, Restaurant)	**29**
Existence of Company Marketing Plan	**30**
Number of National Feed Suppliers (also % imported)	**31**

Based on context-specific indicator quality attributes i.e. scientific validity, influence of on policy formulation, existence of reference values (or the possibility to develop

reference values, baselines or standards) and ease of implementation; 20 indicators were considered as insufficient and were discarded in the first round of discussions. Indicator N^{o} 15 (Number of national feed suppliers) renamed as "Use of imported feed" was left as a pending issue, due to the debate that national fish feed industry is dependent on imported fish meal and fish oil, and use of such indicator to measure self sufficiency in terms of fish feed is logically unjustified.

The remaining 10 indicators were further evaluated in terms of data-specific attributes. Seven indicators were categorized as readily applicable due to readily available data or ease of data collection. Three remaining indicators were considered as potentially applicable due to constraints associated with collection of reliable data for financial indicators (Indicators N^{o} 31,32 & 36) (Table 2).

Three new indicators were proposed and discussed during focus-group consultation (Table 3).

These new indicators were considered to be easily applicable and useful to monitor growth of the industry in monetary terms (*Production value index*), measure level of concentration in the industry (*Concentration ratio, CR_4*) and evaluate input-output price relationships (*Input-output price parity*)

Even though "existence of training schemes for aquaculture workers on environmental aspects of sustainability" was given low priority among economic indicators during TPA-I, the crucial role of workers in improving environmentally friendly practices at production level was underlined during TPA-II. Thus existence of training schemes aiming at awareness building among aquaculture workers was regarded as a positive and practical step for promotion of image of aquaculture. The importance of risk management and use of aquaculture insurance schemes to mitigate stock mortality risk was considered to a crucial issue for sustainable development of the industry. An indicator shedding light on use of aquaculture insurance schemes was stressed to be highly desirable.

Table 2. Classification of economic indicators with regard to their applicability.

N^{o}	Indicator	Enterprise Level	National Level

APPLICABLE INDICATORS			
N° 2	Existence of quality certification schemes by independent bodies for targeted market/s*	Yes/No	% of farms
N° 30	Supply and sales by contract *	% of sales	-
N° 16	Share of imports in net national apparent use of fry *	-	% of total use
N° 8	Sector market studies	Yes/No	% of farms
N° 1	Existence/use of own-label	Yes/No	% of farms
N° 11	Number of products - On-growing: Number of species, size categories or differentiated products. - Processing: Number of value-added products.	Trend compared to a base year (±)	Trend compared to a base year (±)
N° 29	Existence of sales through producer organizations *	Yes/No	% of farms
POTENTIAL INDICATORS			
N° 36	Unit production cost (€/kg, ex-farm)	€/kg	-
N° 31	Gross profit margin	%	-
N° 32	Rate of return on farm assets	%	-

*Remark: Some of the indicators have been rephrased or revised for the sake of clarity during focus-group discussions

Table 3. Newly proposed applicable economic indicators during TPA-II

N°	Indicator	Enterprise Level	National Level
N° 1	Production value index	-	Trend compared to a base year (±)
N° 2	Concentration ratio (CR_4)	-	% share of top 4 or 8 companies
N° 3	Input/output price parity (Marketable fish: feed and fry)	Trend compared to a base year (±)	-

Comparing indicator condition against a reference values/baseline/standard is crucial for monitoring progress towards sustainable development. In this regard selection of reference values or baseline is therefore as important as selection of indicator itself. To this end reference values for applicable, potential and new indicators were either derived from literature review whenever possible or in absence of such reference values practical/meaningful baselines/norms were developed through consultations during focus-group discussions. Reference values/baselines were visualized by "*Traffic Light*" approach to ease interpretation of results and patterns of development towards sustainability.

Environmental dimension

Environmental indicators can play a basic part in discussion with other stakeholders. This is important because it focuses attention on environmental changes and on the process of sustainability. Indicators illuminate the real significance of what is happening. They are being developed to facilitate communication on the present and future state of the environment in relation to environmental policies. DPSIR concepts of driving forces (human activities) causing pressures like nutrients emission, on the environment, thus changing its state and its impact on the ecosystems. Society must respond to reduce the adverse effects. But environmental indicators are difficult to apply. There are measurement problems which must be made over a long period of time to establish trends. This demands a long-term monitoring program requiring equipment, personnel and finance. In this context marine aquaculture is pioneering the necessary strategies in the coastal zone.

The focus-group on the environmental dimension reviewed and discussed an initial set of 41 selected candidate indicators (Table 4). These had all obtained an average score of 5 points or over during the Turkish Pilot Action-I meeting. Based on context-specific indicator quality attributes i.e. scientific validity, influence of on policy formulation, existence of reference values (or the possibility to develop reference values, baselines or standards) and ease of implementation. Twenty of the indicators selected in TPI were discarded for reasons such as duplication or for being too complex for general use. Great care was taken to present scientific principles in a form that was clear to non-scientists. To this end worksheets were prepared to generate discussion. We later visited a non-participant fish farmer to discuss our result in "the field". The final selection is shown in Table 5.

A great deal of time was spent on discussing the fine details of the formulae for indicator N^{o}1, "Food Conversion Ratio Food". Finally it was decided that the simple, practical formulae i.e. Food consumed (kg) / Fish harvested (kg) was enough.

N^{o}10, "Total coliform" is a good indicator of healthy water. Discussion on this indicator produced some important and enlightening ideas. This is an easily understood indicator for all coastal stakeholders/users and can focus a commonality of agreement and cooperation. Indicator N^{o}16 "Monitoring the quality of the fish larvae produced" was changed to "The quality of the fish larvae produced"; the word "monitoring" had not been understood at TPI meeting so it was deleted. The other 5 indicators including "Use of chemical products and drugs", "Impact on benthic habitat and communities". All participants were in agreement that the "Hydrodynamic" indicator was of crucial importance and was a necessary first step in the licensing procedure. Moreover, all participants agreed that N^{o} 40 "Level of degradation of sensitive habitats" was of basic importance. The focus-group proposed TRIX index as a new indicator. For this index DO and *Chl-a* have to be measured and thus it is not necessary to have listed them in the monitoring program. But all TRIX parameters must be separately reported.

Table 4.Initial set of candidate environmental indicators evaluated during focus-group discussions.

Indicator	Rank

Depth (m)	1
Food Conversion ratio (kg food/kg fish)	2
Microbiological indicators (total)	3
Percentage of the used space (%)	4
Hydrodynamic (cm / sec)	5
Interchange with open sea (offshore) distance in meter	6
Turbidity/transparency (Secchi disk cm)	7
Oxygen saturation (%)	8
Turbidity/transparency (Secchi disk cm)	9
Kg of antibiotics per ton fish (kg)	10
Turbidity (Secchi disk cm)	11
Total Particulate Organic Matter (mg/mc	12
Zooplankton biomass (mg/mc)	13
Chlorophyll (mg/mc)	14
Kg of antibiotics per ton fish (kg	15
Total Dissolved Organic Matter (mg/mc)	16
Relationship between exogenous and endogenous	17
Antifouling use (y /n)	18
Level of degradation of sensitive habitats (monitoring)	19
Kg of anti-parasites per ton fish (kg)	20
Kg of disinfectant per ton fish (kg)	21
Volume of water occupied per kg of product(kg/mc)	22
Capture versus Quota (tons/year)	23
Kg of anti-parasites per ton fish (kg)	24
Kg of disinfectant per ton fish (kg)	25
Use of food with chemical antioxidants (y/n)	26
Use of non indigenous species (y/n)	27
Loss of nursery and spawning grounds (yes / no recruitment index and spawning stock biomass)	28
Demand of pelagic fish (tons/year)	29
Total Organic Carbon (TOC mg/mq)	30
Presence of hatchery with native brood	31
Benthic community structure modification (Benthic index)	32
Escapees (ind)	33
Use of native brood stock (y/n)	34
Use of GMO species (y/n)	35
Level of spawning (?)	36
Carrying/holding capacity of the ecosystem	37
Lost food versus total (%)	38
Number of introduced species (n)	39
Use of food with chemical antioxidants (y/n)	40
Presence of pathogens from farm pathogens (y/n)	41

Table 5. Classification of environmental indicators with regard to their applicability

N°	Indicator	Enterprise Level	National Level
APPLICABLE INDICATORS			

No 1	Food Conversion ratio	Food (kg) / Fish harvested (kg)	-
No 10	Total coliform	CFU/ 100ml	MP** Legislative
No 16	The quality of the fish larvae produced	Yes/No	-
No 28	Antibiotics	Anti-biogramme test	-
No 28-30	Antibiotics/ anti-parasites*	Residue (µg/kg)	MP** Legislative
No 29	Antifouling use (y /n)	Yes/No	-
No 38	Benthic community structure modification (Benthic index)*	Index Value	MP** Legislative
No 39	Total Organic Carbon	mg/g	MP** Legislative
POTENTIAL INDICATORS			
No 18	Hydrodynamic *	(cm / sec)	-
No 23	Dissolved Oxygen *	(mg/l)	MP** Legislative
No 40	Level of degradation of sensitive habitats *	(m)	MP** Legislative
No 44	Chlorophyll (mg/l)*	µg/l	MP** Legislative

*Remark: Some of the indicators have been rephrased or revised for the sake of clarity during focus-group discussions

** Monitoring Programme

Table 6. Newly proposed applicable environmental indicators during TPA-II

N°	Indicator	Enterprise Level	National Level
N° 1	TRIX Index	< 4-6>	MP** Legislative
N° 2	Beggioata bacteria	Yes/No	MP** Legislative

Social dimension

Focus-group on social dimension reviewed and discussed an initial set of 12 selected candidate indicators which had obtained an average score of ≥5 points during Turkish

Pilot Action-I (Table 7). Based on context-specific indicator quality attributes i.e. scientific validity, influence of on policy formulation, existence of reference values and ease of implementation; 3 indicators were considered as insufficient and were discarded in the first round of discussions.

Table 7. Initial set of candidate social indicators evaluated during focus-group discussions.

Indicator	Rank
Number of professional associations	1
Annual production	2
Quantity of fish produced for domestic markets (self-consumption) and apparent consumption	3
Existence and importance of interprofessional organizations	4
Number of monthly hours currently worked by aquaculture workers	5
Percentage of fish-farmers with specialized aquaculture training and certificate	6
Percentage of trade union members among workers	7
Number of occupational accidents	8
Percentage of women fish-farmers	9
Minimum wage of employees compared to national minimum wage	10
Existence of ecolabels and product specifications	11
Unmarketable fish ratio	12
Effective participation to decision making process	13
Number of declared pathologies	14
Existence of a professional status	15
Percentage of innovative products proposed each year	16
Percentage of premium quality fish	17
Fish price compared with the minimum wage	18

Indicator N^{o} 1(*Annual production*) was decided to be included in economic dimension. Indicators N^{o} 2 (Quantity of fish produced for domestic markets and apparent consumption) and N^{o} 6 (Percentage of fish-farmers with specialized aquaculture training and certificate) were renamed as "S*eafood consumption per capita*" and "*Percentage of fish-farmers with specialized certification*" respectively for the sake of understandability, applicability and data availability. Indicators considered as applicable and potential are listed in Table 8.

Table 8. Classification of social indicators with regard to their applicability

APPLICABLE INDICATORS			
N^{o}	Indicator	Enterprise Level	National Level

N° 7	Number of professional associations	-	number
N° 2	Seafood consumption per capita*	-	kg/per capita
N° 11	Number of monthly hours currently worked by aquaculture workers	Number of hour	number of hour
N° 6	Percentage of fish-farmers with specialized certification*	-	% of farms
N° 13	Percentage of trade union members among workers	% of workers	% of workers
N° 12	Number of occupational accidents	Number of accident	Number of accident
N° 14	Percentage of women fish-farmers	% of women	% of women
N° 5	Minimum wage of employees compared to national minimum wage	%	%

*Remark: Some of the indicators have been rephrased or revised for the sake of clarity during focus-group discussions

Reference values/baselines were visualized by "*Traffic Light*" approach to ease interpretation of results and patterns of development towards sustainability as same as other dimensions.

Governance dimension

The focus-group on governance dimension reviewed and discussed an initial set of 32 selected candidate indicators which had obtained an average score of ≥5 points during Turkish Pilot Action-I (Table 9). Based on context-specific indicator quality attributes i.e. scientific validity, influence of on policy formulation, existence of reference values and ease of implementation; 22 indicators were considered as insufficient and were discarded in the first round of discussions.

Table 9. Initial set of governance indicators evaluated during focus-group discussions.

Indicator	Rank
Existence of ICZM plan for coastal areas, including aquaculture under head state authority, taking account future evolution of industry.	1

Number of workers (direct and indirect)	2
Number of fish-farmers taking part in consultative bodies	3
Existence of bodies in support to aquaculture training	4
Existence of a public plan to support aquaculture development	5
Existence of extension and dissemination services	6
Existence of research funds	7
Number of control officer	8
Number of new sites created	9
Existence of an information system	10
Existence of funds allocated for training	11
Percentage of permanent (and seasonal) full time equivalent workers	12
Number of new measures co-construct	13
Percentage of fish-farmers in breach of the law	14
Percentage of fish-farmers and technicians who know the regulations	15
Number of participants at consultative meetings	16
Number of authorizations granted compared to the number of requests	17
Existence of a national sustainable development strategy	18
Existence of rules and regulations in favour of sustainable development	19
Number of partnership contracts	20
Existence of subsidies for aquaculture ecologic services	21
Number of area allocated for aquaculture	22
Participation rate to the socio-professional political organizations and in local assemblies	23
Existence of competent State services	24
Rate of State financial aid compared to other sectors	25
Number of concessions and license for aquaculture	26
Percentage of seasonal workers in aquaculture compare to seasonal workers in tourism	27
Number of conflicts solved at local level	28
Number of reports on environmental crises in five years	29
Conflicts and opportunities with other activities and uses	30
Existence of legal recourses	31
Recycling rate of by-product	32
Number of conflicts due to contradictions between traditional and constitutional legislation	33
Age and historical role of the activity and contribution to the traditional landscape of the area	34

Indicators N^{o} 21(Existence of ICZM plan for coastal areas, including aquaculture under head state authority, taking account future evolution of industry), N^{o} 16 (Number of fish-farmers taking part in consultative bodies), N^{o} 20 (Number of new sites created), N^{o} 27 (Existence of a national sustainable development strategy), N^{o} 28 (Existence of rules and regulations in favor of sustainable development) and N^{o} 31(Number of concessions

and license for aquaculture) were renamed as "Existence of ICZM plan for coastal areas, including aquaculture", "Number of new sites created for aquaculture", "Existence of a national aquaculture strategy plans", "Existence of rules and regulations for sustainable development" and "Number of license for aquaculture" respectively for understandability, applicability and data availability. Indicators N^{o} 22 (Existence of research funds) and N^{o} 33 (Existence of funds allocated for training) were combined and was renamed as "Existence of funds for research and training". Indicators considered as applicable and potential are listed in Table 10.

Table 10. Classification of governance indicators with regard to their applicability

APPLICABLE INDICATORS			
N^{o}	Indicator	Enterprise Level	National Level
21	Existence of ICZM plan for coastal areas, including aquaculture*	-	Yes/No
3	Number of workers (direct and indirect)	number	number
16	Number of fish-farmers taking part in decision making process*	-	number
22	Existence of funds for research and training*	Yes/No	% of farms
20	Number of new sites created for aquaculture*	-	Number and rate to meet new investment demands
11	Percentage of fish-farmers and technicians who know the regulations	%	%
27	Existence of a national aquaculture strategy plans*	-	Yes/No
28	Existence of rules and regulations for sustainable development.	-	Yes/No
8	Existence of subsidies for aquaculture ecologic services	-	Yes/No
31	Number of licenses for aquaculture	-	number

*Remark: Some of the indicators have been rephrased, revised or combined for the sake of clarity during focus-group discussions

Reference values/baselines were visualized by "Traffic Light" approach to ease interpretation of results and patterns of development towards sustainability as same as other dimensions.

2.3. Field-Study/Testing of Indicators

2.3.1. Purpose of field-study

To test the applicability of indicators on the field and identify constraints with regard to data availability or accessibility a one-day field study was organized on 23rd of September. Owner

and/or managers of at least one small, medium and large scale enterprise (Table 11) were interviewed face to face and indicators were introduced to;

- ✓ Assess the applicability of indicators from data availability and quality perspective,
- ✓ Evaluate the understandability/clarity of indicators,
- ✓ Understand perceptions of producers with respect to sustainable aquaculture and indicators and
- ✓ Learn priorities of producers regarding different dimensions of sustainability

Table 11. List of enterprises visited during field-study

Enterprise	Category	Scale	Location
A	On-growing cage farm, sea bass and sea bream	Large scale, 6000 tonnes	Güllük Gulf
B	On-growing cage farm, sea bass and sea bream	Medium scale, 1550 tonnes	Güllük Gulf
C	On-growing cage farm, sea bass and sea bream	Medium scale, 1800 tonnes	Güllük Gulf
D	Processing, value-added products	Targeting 12000 tonnes/year	Milas
E	In-land on-growing sea bass and sea bream	Small scale, 420 tonnes	Milas
F	Vertically integrated, on-growing, packaging/processing and feed manufacturing	12000 ton sea bass and sea bream	Milas
G	Feed manufacturing		Milas

2.3.2. Outcomes of filed-study

The main outcomes of testing applicable and potential indicators with regard to data availability and accessibility for economic, environmental, social and governance dimensions are presented in Tables 12-15.

Economic dimension

A general assessment of indicators belonging to economic dimension is presented in Table 12.

Table 12. Outcomes of field-study for economic indicators.

N°	Indicator	Remarks/Weakness

APPLICABLE INDICATORS		
N° 2	Existence of quality certification schemes by independent bodies for targeted market/s*	Data accessible. [1]
N° 30	Supply and sales by contract *	Contact sales in written form is not practiced. Concept not of interest to producers.
N° 16	Share of imports in net national apparent use of fry *	Data avaliable[2]
N° 8	Sector market studies	Not well established and commonly practiced by enterprises. Assessment on national level requires systematic data collection.
N° 1	Existence/use of own-label	Data accessable[1] "Label" need to be further defined and clarified, (Tag, branding).
N° 11	Number of products - On-growing: Number of species, size categories or differentiated products. - Processing: Number of value-added products.	Data avaliable[2]
N° 29	Existence of sales through producer organizations *	Sales through POs not existing due to unclear PO legislation. If practiced, data could be available from POs.
POTENTIAL INDICATORS		
N° 36	Unit production cost (€/kg, ex-farm)	Lack of a common understanding on methodology and cost structure is a constraints for collection of consistent data. Systematic data collection on national level using a standard methodology is required.
N° 31	Gross profit margin	Not easily accessible. Systematic data collection on national level using a standard methodology is required.
N° 32	Rate of return on farm assets	Not easily accessible. Systematic data collection on national level using a standard methodology is required.

1: Data accessible: Data available at enterprise level and can be easily collected.
2: Data available: Data is already collected through different channels/authorities.

Environmental dimension

A general assessment of indicators belonging to environmental dimension is presented in Table 13.

Table 13. Outcomes of field-study for environmental indicators.

Nº	Indicator	Remarks/Weakness
APPLICABLE INDICATORS		
Nº 1	Food Conversion ratio	Data accessible. [1]
Nº 10	Total coliform	Mandatory procedures for data collection do not yet exist.
Nº 16	The quality of the fish larvae produced	Mortality, deformation growth rate needs certification.
Nº28	Antibiotics	Needs regional (e.g.Mugla) common health programme
Nº 28-30	Antibiotics/ anti-parasites	Data accessible from vets.
Nº 29	Antifouling use (y /n)	Data avaliable[1]
Nº 38	Benthic community structure modification (Benthic index)	Lack of a common understanding on methodology
Nº 39	Total Organic Carbon	Currently different method used and intercomparability of results difficult
POTENTIAL INDICATORS		
Nº 18	Hydrodynamic	Systematic data collection on national level using a standard method is required.
Nº28	Dissolved Oxygen	Trix index result reported but DO needs specific details reported.
Nº 40	Level of degradation of sensitive habitats	This needs definition (for exemple distance of Posidonia from cage)

1: Data accessible: Data available at enterprise level and can be easily collected.

Social dimension

A general assessment of indicators belonging to social dimension is presented in Table 14.

Table 14. Outcomes of field-study for social indicators.

APPLICABLE INDICATORS

Nº	Indicator	Remarks/Weakness
Nº 7	Number of professional associations	Data accessible without any cost
Nº 2	Self seafood consumption per capita *	Data accessible without any cost
Nº 11	Number of monthly hours currently worked by aquaculture workers	Data accessible without any cost
Nº 6	Percentage of fish-farmers with specialized certification*	Data accessible, but not easy, can be costly
Nº 13	Percentage of trade union members among workers	Data available, but not easily accessible, can be costly
Nº 12	Number of occupational accidents	Data accessible without any cost
Nº 14	Percentage of women fish-farmers	Data accessible without any cost
Nº 5	Minimum wage of employees compared to national minimum wage	Data accessible without any cost

Governance dimension

A general assessment of indicators belonging to governance dimension is presented in Table 15.

Table 15. Outcomes of field-study for governance indicators.

APPLICABLE INDICATORS		
Nº	Indicator	Remarks/Weakness
21	Existence of ICZM plan for coastal areas, including aquaculture*	Data available. But, basic answer (yes or not) is not enough for evaluation. We need to know level of plans and applicability
3	Number of workers (direct and indirect)	Data accessible without any cost
16	Number of fish-farmers taking part in decision making process*	Not easy correct data collection. It is necessary to make survey study
22	Existence of funds for research and training*	Data accessible without any cost
20	Number of new sites created for aquaculture*	Data accessible without any cost
11	Percentage of fish-farmers and technicians who know the regulations	Not easy correct data collection. It is necessary to make survey study
27	Existence of a national aquaculture strategy plans*	Data accessible without any cost
28	Existence of rules and regulations for sustainable development.	Data accessible without any cost
8	Existence of subsidies for aquaculture ecologic services	Data accessible without any cost. But, basic answer (yes or not) is not enough for evaluation.
31	Number of license for aquaculture	Data accessible without any cost

2.4. General Assessments and Recommendations

- ✓ The general perception of stakeholders towards sustainable aquaculture is dominantly ecological/environment oriented. Economic, social and governance dimensions are overlooked. This is probably the outcome of increasing pressure

and criticism from environmentalists and public, putting only environmental aspects on forefront of sustainability. Organizing workshops with key stakeholders including policy-makers focusing on raising awareness and a broader consensus on concept of sustainability and its four pillars should be a core element of promoting the development of sustainable aquaculture and implementation of any monitoring schemes using sustainability indicators.

- ✓ There are 114 land-based farms (using underground water) in Muğla province producing over 7.000 tonnes of sea bass and sea bream in earthen ponds using underground brackish water. Sea bass and Sea bream produced in these farms fetch a higher price compared to fish reared in cages mainly due to better coloring and resemblance to wild fish. Unlike cage farms which are generally medium to large-scale operations, this segment of marine aquaculture is composed of small-scale family-run enterprises contributing to rural development through job creation and diversification of income. Sustainability of these farms is therefore of prime importance from socio-economic perspective and diversity of production system in Turkey. At this juncture it must be emphasized that the environmental issues have to be figured into socio-economic matters and in this the monitoring of the quality and quantity of water is crucially important. A pilot action focused awareness building and strengthening managerial capabilities of those involved in this segment of marine fish farming would be an interesting "training for sustainability" case-study.

- ✓ Outcomes of both focus-group meeting and field-study reveal that some of the indicators developed during Montpellier-II, need to be further refined, rephrased and sometimes fine-tuned for the sake of clarity. This process should be implemented prior to dissemination of indicators by GFCM-CAQ, with active contribution from the stakeholders.

- ✓ Indicator selection process focusing on bottom-up approach has its merits e.g. promote active participation of stakeholders thereby reflecting their perspectives. However; there is the danger that if a representative cross section (Farmers, administrator, NGO, academicians) is lacking the consultation/selection process may result in set of indicators which lack the capacity to adequately monitor sustainability.

- ✓ Guidelines for reporting and interpretation on the suite of indicators are also an essential element of monitoring sustainability through indicators. This issue needs to be tackled in InDAM annual meeting.

3. METHDOLOGY SHEETS FOR APPLICAIBLE/POTENTAIL/NEW INDICATORS

3.1. Economic Dimension

By

Ferit RAD

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P1- Strengthen Consumer Responsive and Market Oriented Aquaculture		
Criteria : P1C1- Use of Branding or Quality Assurance Schemes/Labels		
Indicator : N^{o} 2- Existence of Quality Certification Schemes by Independent Bodies for Target Market/s		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Certification is an important tool for quality management and product differentiation in aquaculture. Certification is defined by FAO as "Procedures by which certification body or entity gives written or equivalent assurance that a product or service conforms to specified requirements (FAO Guidelines on Aquaculture Certification). Certification schemes can address different aspects e.g. "animal health and welfare", "food safety", "environmental integrity", "organic farming" and ethical (Social) issues. Certification schemes can be retail, country or regional specific. "GlobalGap" and BRC (British Retail Consortium) are examples of business to business assurance labels required by retailers in Europe.

2. METHODOLOGY

Calculation/Formula:

Enterprise level: *Existence of quality certification scheme/s (Yes/No or at planning stage)*

National level: *Percentage of enterprises having quality certification scheme/s*

No. of enterprises with quality certification schemes ÷ Total no. of enterprises (to be calculated for each segment separately)

Segmentation: *On-growing farms/Hatcheries/Packaging and Processing*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable
Strong

No quality certification	Planning for quality certification	Quality certification/s exist

National level:

Vulnerable	≤50%	≥75%	Strong
Enterprises with quality certification schemes	Enterprises with quality certification schemes	Enterprises with quality certification schemes	

Implementation frequency:

The trend can be followed on annual bases or every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data accessible and can be directly collected from enterprises. A systematic data collection scheme at national level would be helpful.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P2- Strengthen Risk Assessment and Crisis Management Capabilities		
Criteria : P1C7- Level of Market Maturity		
Indicator : N° 30- Supply and Sales by Contract		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

Contracts are tools to reduce risk and transaction costs. They provide the contacting parties with offsetting benefits. Use of short- and long-term contracts has a long history in agriculture industry. Sales through contracts help to regulate quantity flow and better production planning and further to reduce price volatility[1]. Contact sales can thus stabilize prices and reduce market risks, especially if contracts signed are long-term. Contracts may also specify management practices to be associated with the production of the commodity[2]. Wide range of sale contracts exist e. g. fixed price, spot price and forward price contracts.

2. METHODOLOGY

Calculation/Formula:

Enterprise level: *Share of contract sales compare to total sales of the enterprise (% of total sales)*

Segmentation: *On-growing farms/Hatcheries/Packaging and Processing/Exporting companies*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable	≤25%	≥50%	Strong
Share of sales by contract	Share of sales by contract	Share of sales by contract	

Implementation frequency:

The trend can be followed on annual bases or every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data should be directly collected from enterprises. A systematic data collection scheme at national level would be helpful.

1: Larsen, T. and Asche, F. 2011. Contracts in the salmon aquaculture industry: An analysis of Norwegian salmon exports. *Marine Resource Economics, Volume26. Pp.141-150.*

2: Engle, C.R. 2010. Aquaculture economics and financing: Management and analysis. Wiley-Blackwell.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P2- Strengthen Risk Assessment and Crisis Management Capabilities		
Criteria : P2C2- Level of Input Self-sufficiency		
Indicator : N° 16- Share of Imports in Net National Apparent Use of Fry		
Applicable at:	Enterprise level	✓ National level

1. DEFINITION

Self-sufficiency in terms of inputs used in aquaculture production is a major policy issue for development of sustainable aquaculture operations. Fry is one of the major inputs used in production of farmed products. Availability of local hatcheries and fry is therefore of prime importance not only for ensuring sustainable supply of farmed products but also to mitigate the costs and risk associated imported fries.

2. METHODOLOGY

Calculation/Formula:

National level: [*No of imported fry in a specific year ÷ Net apparent use of fry in a specific year] x 100*

Net apparent use of fry in specific year = Total N^{o} of locally produced fry- N^{o} of exported fry + N^{o} of imported fry.

Segmentation: *Species-specific e.g. sea bass, sea bream, meager*

Reference Values/Baseline/Standard:

National level:

Vulnerable ≥30%	20%	≤20% Strong
Share of imported fry	Share of imported fry	Share of imported fry

Implementation frequency:

The trend can be followed on annual bases or every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data on imported and exported fries are generally available and published under fisheries statistics. If not such data can be obtained from Custom or affiliated Administrations. Data on total domestic production of fry can be collected from local hatcheries.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P1- Strengthen Consumer Responsive and Market Oriented Aquaculture		
Criteria : P1C5- Level of Knowledge Management		
Indicator : N^{o} 8- Sector Market Studies		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Market-oriented aquaculture entails knowledge on customers, competitors and markets. Therefore; market studies are essential for formulating marketing strategies and for decision-making process. Market research or study can be defined as the process of gathering, analyzing and evaluating information on customers/consumers, markets or a product. According to Engle and Quagrainie[1] market research is essential to overall success of any business because major objectives of any seafood producing business are to meet consumer demand and operate efficiently at a profit. Market study can be exploratory, qualitative or quantitative research1.

2. METHODOLOGY

Calculation/Formula:

Enterprise level: *Existence of sectoral market study (Yes/No)*

National level: [*N° of enterprises conducting market studies ÷ Total N° of enterprises] x100*

Segmentation: *On-growing farms/Hatcheries/Packaging and Processing/Exporting companies*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable
Strong

Does not conduct any market study	Is planning to conduct market study	Does conduct market studies

National level:

Vulnerable	≤25%	≥50%	Strong
Percentage of enterprises conducting market studies	Percentage of enterprises conducting market studies	Percentage of enterprises conducting market studies	

Implementation frequency:

The trend can be followed on annual bases or every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data is not generally easily accessible and must be collected from enterprises. A systematic data collection scheme may be required.

1: Engle, C.R. and Quagrainie, K. 2006. Aquaculture marketing handbook. Blackwell Publishing.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P1- Strengthen Consumer Responsive and Market Oriented Aquaculture		
Criteria : P1C1- Use of Branding or Quality Assurance Schemes/Labels		
Indicator : N° 1- Existence/Use of Own-Label		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Brand names provide some sense of satisfaction and security to consumers and develop brand loyalty[1]. According to Engle and Quagrainie[1] brand identification has not developed widely in seafood market, but as aquaculture industry continues to grow and supplies increase, brand development would be expected to offer some market advantages through differentiating product and developing brand loyalty. Use of own-label here refers to use of company's own name, symbol or logo to differentiate its product from others, e.g. use of gill tags.

2. METHODOLOGY

Calculation/Formula:

Enterprise level: *Use of company's' own-label (Yes/No)*

National level: [*N° of enterprises using its own-label ÷ Total N° of enterprises] x100*

Segmentation: *On-growing farms/Packaging and processing companies*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable
Strong

Not using own-label	Planning to use own-label	Using own-label

National level:

Vulnerable	≤25%	≥50%	Strong
Percentage of enterprises using own-label	Percentage of enterprises using own-label	Percentage of enterprises using own-label	

Implementation frequency:

The trend can be followed on annual bases or every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data are easily accessible but need to be collected directly from enterprises.

1: Engle, C.R. and Quagrainie, K. 2006. Aquaculture marketing handbook. Blackwell Publishing.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P2- Strengthen Risk Assessment and Crisis Management Capabilities		
Criteria : P2C1- Level of Diversification		
Indicator : N° 11- Number of Products		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Product diversification and differentiation are essential components of a successful marketing strategy to mitigate risks associated with price volatility and market failures. Product diversification and differentiation in aquaculture can be achieved through species and size (categories) diversification or modifying product attributes (e.g. fat content, coloring or organic fish).

At enterprise level number of products for on-growing farms here, refers to number of cultured marine species, size categories produced or any product with differentiated attributes. For processing companies number of products refers to different value-added products. At national level this indicator refers to number of marine species domesticated and commercially produced by hatcheries and species reared by on-growing farms to market size. .

2. METHODOLOGY

Calculation/Formula:

Enterprise level:

On-growing farms: *N° of species cultured/size categories/differentiated product*

Hatcheries: *N° of species domesticated and cultured commercially*

Processing companies: *N° of valued-added products*

National level:

On-growing farms and hatcheries: *N° of species cultured commercially*

Segmentation: *On-growing/hatcheries*

Reference Values/Baseline/Standard:

Enterprise & national level:

Vulnerable		Strong
N°< Base year	N° = Base year	N°> Base year
N° of products	N° of products	N° of products

For on-growing farms and hatcheries: 3 products namely, sea bass/sea bream and meager can be regarded as reference values in 2011.

Implementation frequency:

The trend should be followed every 5 years.

3. SOURCES of DATA and INFORMATION

Data are easily accessible and can be collected directly from enterprises. Data on cultured species would be readily available e.g. Fisheries statistics. Other product categories e.g. number of value-added products, size categories need to be collected under a systematic data collection scheme.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/APPLICABLE INDICATOR

Principle : P2- Strengthen Risk Assessment and Crisis Management Capabilities		
Criteria : P1C7- Level of Market Maturity		
Indicator : N° 29- Existence of Sales Through Producer Organizations		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Aquaculture producer organizations can play an important role in regulating supply to ensure the best market conditions for fish farmers. Collective marketing through producer organizations help farmers to achieve concentration of supply and increase their negotiation power in marketplace. Joining a producer organization would also enable members to benefit from economies of scale and reduce production costs. Collective certification or development of codes for responsible practices through producer organization also allows farmers to improve their quality management capabilities. Producer organization here refers to cooperatives and any other formal/informal membership-based organization created by producers.

2. METHODOLOGY

Calculation/Formula:

Enterprise level: *Existence of sales through producer organizations (Yes/No)*

National level:

[N^{o} of enterprises selling their products through producer organizations ÷ Total N^{o} of enterprises] x 100

Segmentation: *Only on-growing farms*

Reference Values/Baseline/Standard:

National level:

Vulnerable	≤30%	≥70%	Strong
Percentage of farms selling through POs	Percentage of farms selling through POs	Percentage of farms selling through POs	

Implementation frequency:

The trend should be followed every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data could be collected directly from farms or producers organizations. But need to be collected under a systematic data collection scheme.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/POTENTIAL INDICATOR

Principle : P3- Strengthen Financial Management of Enterprises		
Criteria : P3C2- Level of Input Efficiency		
Indicator : N^{o} 36- Unit Production Cost (€/kg, ex-farm)		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

Unit production cost measures the cost of producing a single unit (e.g. €/kg) of product and is a good indication of input use efficiency in an enterprise. Production costs consist of variable and fixed costs. Variable costs are those cost items which change in proportion with volume of production, e.g. feed, fry, labor, energy medicine/ veterinary services, repair& maintenance, sales/harvesting and interest on operating capital. Fixed costs are those which do not dependent on level of output e.g. depreciation, site rent charges/fees, management (managers' salary) and interest on capital investment. All producers do trace their unit production cost. However, due to lack of a common understanding on cost structure and methodological approach, many tend to include only the major variable cost items (Feed, fry, labor and energy). This inconsistency in methodological approach can lead to inconsistent data misinterpretation.

2. METHODOLOGY

Calculation/Formula:

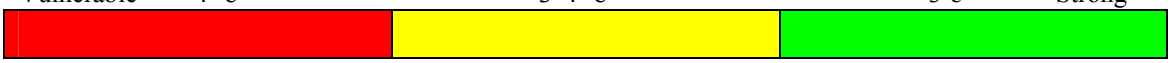
Enterprise level: *[Total variable costs (VC) + Total fixed costs (FC)] ÷ Output (kg)*

Segmentation: *Only for on-growing cage farms-Species-specific, e.g. Seabass/seabream, meager*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable >4 € 3-4 € < 3 € Strong



Implementation frequency:

The trend should be followed every year.

3. SOURCES of DATA and INFORMATION

Data on unit production cost or cost items should be collected directly from enterprises. Systematic data collection scheme at national level using an standard methodology would improve consistency and quality of data.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/POTENTIAL INDICATOR

Principle : P3- Strengthen Financial Management of Enterprises		
Criteria : P3C1- Level of Profitability		
Indicator : N^{o} 31- Gross Profit Margin		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

Profitability measures the extent to which an enterprise generates profit from the use of land, labor, management and capital[1]. Profitability ratios are important tools to evaluate financial success of an investment or enterprise. Gross profit margin is one of the commonly used ratios to evaluate profitability and is calculated by dividing gross profit by revenue (sales) and multiplying by 100. Gross profit margin measures the sales and production performance and can be used to compare performance of similar aquaculture businesses[2].

2. METHODOLOGY

Calculation/Formula:

Enterprise level:

Gross profit = Revenue – Total variable production costs

Gross profit margin = [Gross profit ÷ Revenue] x 100

Segmentation: *Only for on-growing cage farms-Species-specific, e.g. Seabass/seabream, meager*

Reference Values/Baseline/Standard:

Enterprise level:

High gross profit margins indicate healthy financial performance. It is difficult to specify a baseline or reference values. Low gross profit margin reveal high production costs or low sale prices.

Implementation frequency:

The trend should be followed every year.

3. SOURCES of DATA and INFORMATION

Gross profit margin is computed from income statement of an enterprise. Not easily accessible. Systematic data collection scheme at national level required.

1: Langemeier, M.R. 2008. Financial rations used in financial management. Kansas State University, MF-270.

2: Engle, C.R. 2010. Aquaculture economics and financing: Management and analysis. Wiley-Blackwell.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/POTENTIAL INDICATOR

Principle : P3- Strengthen Financial Management of Enterprises		
Criteria : P3C1- Level of Profitability		
Indicator : N^{o} 32- Rate of Return on Farm Assets		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

Profitability measures the extent to which an enterprise generates profit from the use of land, labor, management and capital[1]. The rate of return on farm assets (ROA) measures the profits obtained from the use of all capital (debt and equity capital) invested in the business. It can be viewed as an interest rate earned from investing capital in farming and compares the profit generated to the value of assets used[2]. If farm assets are valued at market value, the rate of return on farm assets can be looked at as, the opportunity cost of investing in farm business instead of alternative investments[3]. ROA can be compared to other similar farms or opportunity cost of the capital.

2. METHODOLOGY

Calculation/Formula:

Enterprise level: *ROA = [Return to assets ÷ Average asset value] x 100 (From Engle, C.R. 2010)*[2]

Return to assets = Net farm income from operations + interest expenses - Opportunity cost of unpaid labor/ management

Segmentation: *Only for on-growing cage farms-Species-specific, e.g. Seabass/seabream, meager*

Reference Values/Baseline/Standard:

Enterprise level:

ROA is industry-specific usually lower in agricultural investments. ROA could be compared with returns from alternative investments. From leverage point of view ROA should at least be greater than interest rate on debt.

Vulnerable		Strong
< Interest rate on debt	= Interest rate on debt	> Interest rate on debt

Implementation frequency:

The trend should be followed every year.

3. SOURCES of DATA and INFORMATION

Enterprise income statement and balance sheet is needed to compute return on farm assets ratio. Not easily accessible. Systematic data collection scheme at national level required.

1: Langemeier, M.R. 2008. Financial rations used in financial management. Kansas State University, MF-270.

2: Engle, C.R. 2010. Aquaculture economics and financing: Management and analysis. Wiley-Blackwell.

3: Olson, K. D.2004. Farm management: Principles and strategies. Balckwell publishing.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/NEW INDICATOR

Principle :		
Criteria :		
Indicator : N^{o} 1- Production Value Index		
Applicable at:	Enterprise level	✓ National level

1. DEFINITION

Tracing value of production over time provides insights on evolution of both volume and price of a product. Production value index (PVI) measures the change in value of production over time and thus shed light on growth patterns for a specific product or a sector (aquaculture) or a sub-sector (e.g. Sea bass farming). Definitely, growth patterns would have implication with regard to market conditions and economic sustainability.

2. METHODOLOGY

Calculation/Formula:

National level: *PVI = [Value of production in current year] ÷ [Value of production in the base year] x 100*

*Value of production = Volume of production (mt) x real price**

**Current price should be inflation-adjusted and converted to real price using a deflator.*

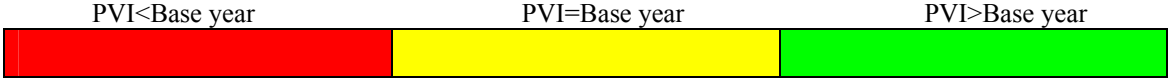
Segmentation: *Species-specific, e.g. seabass, seabream, meager*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable Strong

PVI<Base year PVI=Base year PVI>Base year



Implementation frequency:

The trend should be followed every year.

3. SOURCES of DATA and INFORMATION

Data needed to compute PVI are collected at national level and readily available through Fisheries Statistics.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/NEW INDICATOR

Principle : P3- Strengthen Financial Management of Enterprises		
Criteria : P3C5- Ease of Entry Into Industry		
Indicator : N° 2- Concentration ratio (CR_4)		
Applicable at:	Enterprise level	✓ National level

1. DEFINITION

Concentration ratio (CR) shed light on structure of the industry by measuring the proportion of total output produced by given number of largest enterprises within an industry. CR is used to reveal whether an industry is composed of few large-scale or many small-scale enterprises. Four-firm concentration ratio (CR_4) refers to the share of four largest enterprises in total output produced by the industry. A high degree of concentration in an industry would mean that few large-scale enterprises can control the market and diminish competitiveness.

2. METHODOLOGY

Calculation/Formula:t

National level: *CR_4 = [Total output by largest four enterprises (mt)] ÷ [Total output by industry (mt)] x 100*

Segmentation: *on-growing/hatchery production- Could be computed for a single species or industry as a whole*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable $CR_4 \geq 50\%$	CR_4 = 34-49%	$CR_4 \leq 33\%$ Strong
Highly concentrated	Moderately concentrated	Lowly concentrated

Developed from: Hoskins e. al. (2004)[1]

Implementation frequency:

The trend should be followed every year.

3. SOURCES of DATA and INFORMATION

Data needed to compute CR_4 are readily available through licensing schemes of farms. If, licensing schemes are not existing data need to be collected from farms.

1: Hoskins, C., Mc Fadyen, S. M. and Finn, A. 2004. Media Economics, Applying economics to new and traditional media. Sage Publication.

INDICATOR METHODOLOGY SHEET/ECONOMIC DIMENSION/NEW INDICATOR

Principle : P3- Strengthen Financial Management of Enterprises		
Criteria : P3C2- Level of Input Efficiency		
Indicator : N^o 3- Input/output Price Parity (Marketable Fish : feed and fry)		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

From economic point of view, feasibility and sustainability of production depends *inter alia* on favorable input-output price relationships. Increase in prices and thus costs of inputs used in production would have a negative impact on profit generated from sales of output. Input-Output price parity is commonly used in agriculture industry by farmers and policy-makers to evaluate and trace input(s)-output price relationship(s). In intensive marine aquaculture, inputs such as feed and fry constitute an important portion of production cost. Any increase in price of these inputs not compensated for by increase in price of fish produced would hinder production. Thus price parities of these inputs with respect to price of fish produced would have an influential impact on feasibility and sustainability of farming operations.

2. METHODOLOGY

Calculation/Formula:

National level: *Input/output price parity = Unit price of output (€) ÷ Unit price of input (€)*

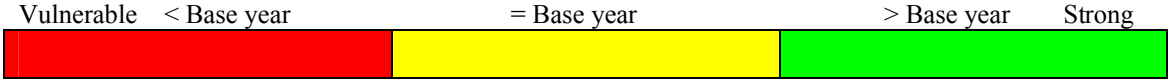
Parities could be compared to a base year to see the trend (±)

Segmentation: *Feed and fry*

Reference Values/Baseline/Standard:

Enterprise level:

Vulnerable < Base year = Base year > Base year Strong



Implementation frequency:

The trend should be followed every year.

3. SOURCES of DATA and INFORMATION

Data on prices of fry and feed can be directly collected form hatcheries and feed manufacturers or indirectly from on-growing farms. A systematic data collection scheme at national level may be required.

3.2. Enviromental Dimension

By

Güzel YÜCEL GIER

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P1- Minimizing the global impact of aquaculture		
Criteria : P1C1- Needs of the natural resource (pelagic fish and plants)		
Indicator : N^{o} 1- Food Conversion Ratio		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

Food Conversion Ratio (FCR) is the ratio between the dry weight of feed fed and the weight of yield gain (FA0, 2008). FCR is an appropriate threshold minimizing the global and local impact of aquaculture. This is because it is an indication that minimal waste food is entering the environment.

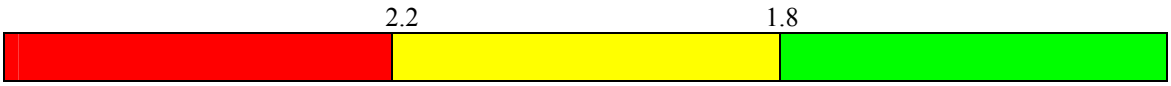
2. METHODOLOGY

Calculation/Formula:

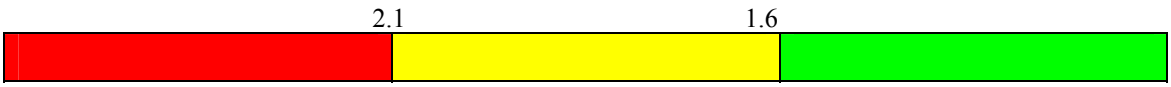
FCR is calculated from the number of kilos of feed that are used to produce one kilo of whole fish. It is a measure of the efficiency of the conversion of feed into fish (e.g. an FCR = 1.8 means that 1.8 kg of feed is needed to produce one kilogram of fish, live weight).

Reference Values/Baseline/Standard:

Sea Bass: 350-400 gr



Sea Bream: 300-350 gr



Implementation frequency:

The trend can be followed on annual bases or every 3-5 years.

3. SOURCES of DATA and INFORMATION

Data collected during the workshop and after field work.

1:FAO, 2008. Glossary of Aquaculture, Fisheries and Aquaculture Department, Roma.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P2- Respect the ecological service of ecosystem		
Criteria : P2.C1- Water quality		
Indicator : N^{o} 10- Microbiological indicators (Total coliform)		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Total Coliform refers to bacteria present in the public water systems: they are a useful indicator of most bacterial pathogens. Total Coliforms are abundant in the feces of warm-blooded animals, but can also be found in the aquatic environment, in soil and on vegetation. They are easy to culture and their presence is used to indicate that other pathogenic organisms of fecal origin may be present (http://en.wikipedia.org/wiki/Coliform_bacteria).

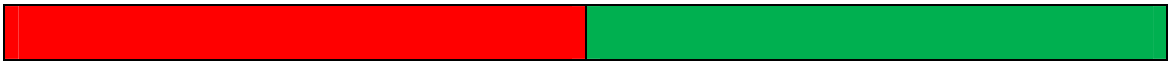
2. METHODOLOGY

Calculation/Formula:

Membrane filtration Culture Method is used for enumeration of Total Coliforms (TC) in seawater (WHO/UNEP, 1994).

Reference Values/Baseline/Standard:

≤1000 CFU/100ml



(MEF, 2004)

Implementation frequency:

Seasonally

3. SOURCES of DATA and INFORMATION

Data can be obtained after the monitoring. Currently no data has been obtained.

1:MEF, 2004. Water Pollution Control Regulations, Official Gazette.No. 25687. In Turkish.

2:WHO/UNEP. 1994. Guidelines for health-related monitoring of coastal recreational and shellfish areas: Part II, Bacterial indicator organisms EUR/ICP/CEH 041(3) Copenhagen.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P2- Respect the ecological service of ecosystem		
Criteria : P2.C2- Fisheries and nursery area		
Indicator : N^{o} 16- The quality of the fish larvae produced		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

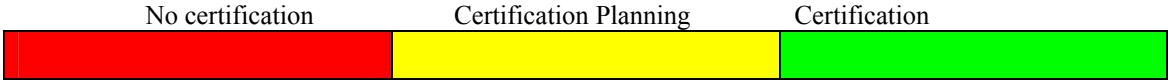
Mortality, deformation growth rate needs certification. The growing to depends on the quality of fry. The feed Conversion and mortality and speed of growth very much depend on this issu.

2. METHODOLOGY

Calculation/Formula:

Certification of quality of fry can be use in this matter.

Reference Values/Baseline/Standard:



3. SOURCES of DATA and INFORMATION

Data can be obtained from hatchery and fams.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P3-Minimizing the local impact on environmental conditions and biodiversity		
Criteria : P3C2-Use of chemical drugs		
Indicator : N^{o} 28- Antibiotics		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Antibiotics are widely used in the prevention and treatment of infectious diseases.

http://www.thefreedictionary.com/antibiotic)

2. METHODOLOGY

Calculation/Formula:

Antibiogramme tests are laboratory techniques to test the sensitivity of a bacterial strain vis-à-vis one or more antibiotics known or assumed.

Reference Values/Baseline/Standard:

No Antibiogramme test	*Planning of Antibiogramme test*	*Antibiogramme test*

Implementation frequency:

At the beginning of disease.

3. SOURCES of DATA and INFORMATION

The veterinary report from the farm .

4. DIFFICULTY

Only a vet or qualified marine-biologist can do this.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P3-Minimizing the local impact on environmental conditions and biodiversity		
Criteria : P3C2-Use of chemical drugs		
Indicator : N^{o} 28- Antibiotics and anti-parasites		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

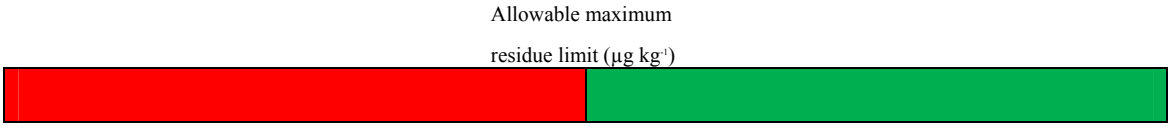
Antibiotics are widely used in the prevention and treatment of infectious diseases http://www.thefreedictionary.com/antibiotic). Anti-parasites are a class of medications which are indicated for the treatment of parasitic diseases.

2. METHODOLOGY

Calculation/Formula:

The program for the monitoring of residues are administered by the laboratories of the Veterinary Control and Research Institutes. Define the method regarding the substance.

Reference Values/Baseline/Standard:



Implementation frequency:

The monitoring program is carried out in fish farms, hatcheries, and retail and wholesale markets. In determining the number of samples to be taken from aquaculture facilities, institutions with an annual production of 50 tonnes or more. In Turkey facilities that export to the EU have priority.

3. SOURCES of DATA and INFORMATION

The program for the monitoring of residues is administered by the laboratories of the Veterinary Control and Research Institutes of MARA. The data can be reached there.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P3-Minimizing the local impact on environmental conditions and biodiversity		
Criteria : P3C2-Use of chemical products and drugs		
Indicator : N^{o} 29- Anti fouling (Y/N)		
Applicable at:	✓ Enterprise level	National level

1. DEFINITION

Anti-fouling paint is a specialized coating applied to cage netting in order to slow the growth of organisms that attach themselves to the structure and can affect performance and durability.

2. METHODOLOGY

Calculation/Formula:

Different anti-fouling substances are needed for different netting materials and thus measure methods must change.

Reference Values/Baseline/Standard:

Implementation frequency:

In summer temperature increase means more frequent testing is needed.

3. SOURCES of DATA and INFORMATION

Generally sea bream farmers do not use antifouling materials because sea bream feed on the fouling organisms. But sea bass do not do this. Therefore antifouling materials are used and this is controversial. "Best practice" conditions are being negotiated.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P3- Minimizing the local impact on environmental conditions and biodiversity		
Criteria : P3C3- Impact on benthic habitat and communities		
Indicator : N^{o} 38- Benthic community structure modification (Benthic index)		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Organisms live in aquatic environments with different levels of pollution and of ecosystem degradation. Some show reaction by an increase in their numbers. Other species rapidly decrease. The variety of benthic organisms provide a variety of pollution indices. The benthos is the community of organisms which live on, in, or near the seabed. The Benthic Index accurately describes the condition of the environment. Benthic organisms in the immediate vicinity of the cages are influenced by the amount of accumulated organic matter.

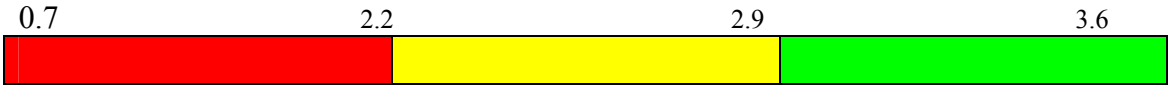
2. METHODOLOGY

Calculation/Formula:

Sediment samples are collected seasonally from seven stations using a Van-Veen Grab sampler. All macrofaunal samples are sieved through a 0.5mm mesh. Organisms retained on the sieve are preserved in a 4% formalin solution. The samples are examined under a stereomicroscope. Samples are sorted to find the major group. The number of individuals (m^{-2}) and total wet biomass (gm^{2}) were determined separately for each taxa and total group at authorized stations.

Reference Values/Baseline/Standard:

Biodiversity indeks (H')



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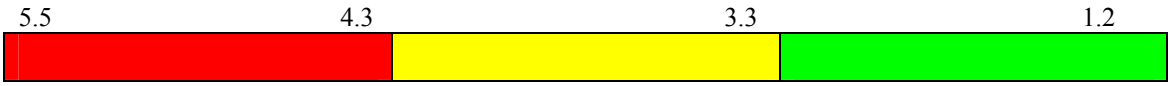
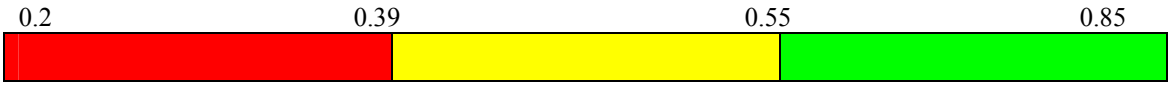


M-AMBI



(Todorova ve ark.,2008)

Implementation frequency:

The trend can be followed on a seasonal basis. Two years needed to establish an accurate baseline.After than once time per year.

3. SOURCES of DATA and INFORMATION

The data can be obtained by a monitoring program.

4- REMARKS

Benthic expert required.

1:Todorova, V ., Trayanova A., Konsulova,T.,2008. Report Biological Monitoring Of Coastal Marine Waters And Lakes - Benthic Invertebrate Fauna, Bulgarian Academy of Sciences Institue of Oceanology.46p.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION

Principle : P3- Minimizing the local impact on environmental conditions and biodiversity		
Criteria : P3C3- Impact on benthic and communities		
Indicator : N^{o} 10- Total Organic Carbon (TOC)		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

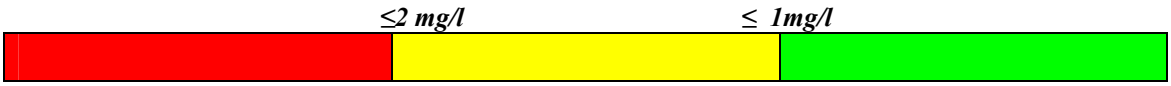
Organic carbon is another indicator of organic pollution in the sediment. Deposition of organic material under the cages may cause changes in the composition of benthic communities such as abundance, dominance and species richness (Arzul et al.,2001).

2. METHODOLOGY

Calculation/Formula:

Sediment samples are collected with a small stainless steel Van-Veen Grab sampler and stored frozen at -20℃ for organic carbon analysis. The amount of organic carbon and organic matter were determined spectrophotometrically in sediment samples following the sulphochromic oxidation method. The accuracy of this method is ± 0.017% organic matter (HACH Publication1988).

Reference Values/Baseline/Standard:



Implementation frequency:

Two times per year.

3. SOURCES of DATA and INFORMATION

Data can been obtained after the monitoring program.

References

1:HACH Publication. (1988) Procedures for water and wastewater analysis, DR/2000 Spectrophotometer handbook.

2:TUBITAK, 2008. "Urban wastewater management along coastal areas of Turkey. Reidentification of hot spots & sensitive areas; determination of assimilation capacities by monitoring and modeling and development of sustainable urban wastewater investment plans" TUBITAK (The Scientific & Technological Research Council of Turkey) Project (107 6067). Progressive Report 1.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION/ POTENTIAL INDICATOR

Principle : P2- Respect the ecological service of ecosystem		
Criteria : P2C4- Oceanographic conditions		
Indicator : No 18- Hydrodynamics (cm/sn)		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

The horizontal and vertical circulation of waters are called currents.

2. METHODOLOGY

Calculation/Formula:

The surface current speeds are measured using current meter. For example: Andrea RCM

Reference Values/Baseline/Standard:

Systematic data collection at a national level using a standard method is required followed by annual monitoring.

3. SOURCES of DATA and INFORMATION

Can be obtain some spesific local report

4. REMARKS

Before any farm is established hydrodynamic conditions must be studied.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION/ POTENTIAL INDICATOR

Principle : P2- Respect the ecological service of the ecosystem		
Criteria : P2C5- Trophic conditions		
Indicator : N^{o} 23- Dissolved Oxygen mg/l		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

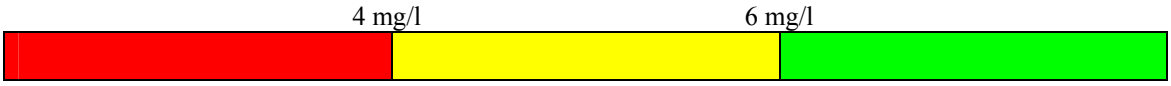
Oxygen is dissolved directly from the atmosphere at the air-sea interface or made available chemically by photosynthesis of plants in water (Bhatt, 1978). Oxygen inputs by diffusion across the air/water interface are negligible and a major source of DO is the water flux through the cage caused by external currents and the movements of the caged fish. Essential for life processes of most aquatic organisms. Low concentrations indicate excessive organic loads. High values indicate excessive plant production (eutrophication). This and super-saturation can sometimes be harmful for organisms.

2. METHODOLOGY

Calculation/Formula:

Dissolved oxygen (DO) is measured in standard solution units such as milliliters O2 per liter (ml/l), millimoles O2 per liter (mmol/l), milligrams O2 per liter (mg/l) using oxygen-meter and classical Winkler procedure.

Reference Values/Baseline/Standard:



(Egemen & Sunlu, 2003; MARA, 2006)

More than 90% of saturated oxygen is satisfactory (MEF, 2004).

Implementation frequency:

Sampling should be made as often as possible.

3. SOURCES of DATA and INFORMATION

Data is collected at farm level and also monitored by universities or private laboratory.

1:Bhatt, 1978. Oceanography. Exploring the Planet Ocean. ISBN: 0-442.20698-4. D.Van Nostrand Company. Newyork..

2:Egemen,O & Sunlu,U., 2003. Su Kalitesi Ege Üniversitesi Yayın No:14. Ege Üniversitesi Basımevi,Bornova, Izmir.

3:MARA, 2006. Circular Based on the regulation of Aquaculture 2005.

4:MEF, 2004: Water Pollution Control Regulations, Official Gazette. No. 25687, In Turkish.

INDICATOR METHODOLOGY SHEET/ENVIRONMENTAL DIMENSION/ POTENTIAL INDICATOR

Principle : P3- Minimizing the local impact on environmental conditions and biodiversity		
Criteria : P3C3-Impact on benthic habitat and communities		
Indicator : No 23- Level of degradation of sensitive area		
Applicable at:	Enterprise level	✓ National level

1. DEFINITION

Seagrass *Posidonia oceanica* meadows are essential ecosystems playing a major ecological role in the Mediterranean coastal zone preventing coastal erosion. They support biodiversity and water transparency, and oxygenate water and sediments. Due to the sensitivity of seagrass meadows to aquaculture activity, vertical rhizome growth can be used as an early indicator of fish farm impacts on meadows.

2. METHODOLOGY

Calculation/Formula:

- Determination of epiphyte biomass on *Posidonia* particularly algal biomass.
- Determination of some indicator species which use leaf as substrate (epiphyte)
- Determination of shoot density, leaf morphology of *Posidonia* (leaf, length,width,leaf surface area)

Reference Values/Baseline/Standard:

More than the minimum distance of the fish farm from *Posidonia* must be establised before licensing granted for fish farm.

INDICATOR METHODOLOGY SHEET/ENVIROMENTAL DIMENSION/NEW INDICATOR

Principle : P2- Respect the ecological service of the ecosystem		
Criteria : P2C1- Water Quality		
Indicator : N^{o} – Trix Index		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

Assessment of the risks and impacts of eutrophication in estuarine and coastal waters is one of the key issues in environmental management, (Painting et al., 2005). The TRIX method has sometimes been used in European countries for the classification of the trophic status of a water body. This is due to its simplicity of application. TRIX can provide useful information for decision-making. However it needs to be linked with other sources of information to draw the broader picture necessary for adaptive management of coastal waters.

2. METHODOLOGY

Calculation/Formula:

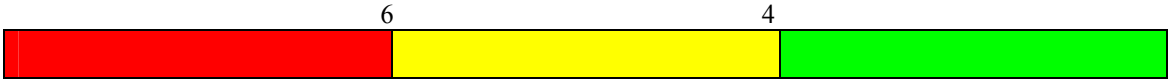
TRIX (Trophic Index) = [log (Chl-*a* *D %O *DIN x TP) – (- 1.5)] / 1.2

Each of the four components represents a trophic state variable:

Chl-*a* = chlorophyll-a concentration, as µg L^{-1}, a D%O =oxygen as absolute % deviation from saturation,

DIN =(N-NO3) + (N-NO2) + (N-NH4), as µg L^{-1}, TP = total phosphorus, as µg L^{-1} , scaling factors of 1.5 and 1.2 were based on an extended dataset concerning the northern Adriatic Sea. (MEF, 2007)

Reference Values/Baseline/Standard:



(MEF, 2007)

MEF, 2007. The notification to identify the closed bay and gulf qualified sensitive where fish farms are not suitable to be established in the seas. Turkish Official Gazette No. 26413.

Painting, S. J.; Devlin, M. J.; Rogers, S. I.; Mills, D. K.; Parker, E. R.; Rees, H. L., 2005: Assessing the suitability of OSPAR EcoQOs for eutrophication vs ICES criteria for England and Wales. Mar.Pollut. Bull. 50, 1569–1584.

INDICATOR METHODOLOGY SHEET/ENVIROMENTAL DIMENSION/NEW INDICATOR

Principle P3 : Minimizing the local impact on environmental conditions and biodiversity		
Criteria P3C3: Impact on benthic habitat and communities		
Indicator : N^{o} – Beggioata bacteria		
Applicable at:	✓ Enterprise level	✓ National level

1. DEFINITION

The organisms live in sulfur-rich environments. Beggiatoa can be found in marine or freshwater environments. They can usually be found in habitats that have high levels of hydrogen sulfide. They appear as a whitish layer and since they are present and flourish in marine environments which have been subject to pollution, they can be considered as an indicator species.

2. METHODOLOGY

Calculation/Formula:

Use of microscope to detect Beggioata.

Reference Values/Baseline/Standard:

Yes	***None***

(MEF, 2009)

MEF, 2009. The notification to monitoring of marine fish farm. Turkish Official Gazette No. 27257.

3.3. Social Dimension

By

Hayri DENIZ

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 2: Strengthen the role of the Producer Organizations and NGO's to improve image of aquaculture, social awareness and responsibilities		
Criteria : P2C3- Importance of fish farmer organizations		
Indicator : N^{o} 7- Number of professional associations		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Term is used in aquaculture to describe the number of professional associations are a non-profit organizations seeking to further a particular profession, the interests of individuals engaged in that profession, and the public interest (from Wikipedia, the Free Encyclopedia)

The roles of these professional associations have been variously defined: "A group of people in a learned occupation who are entrusted with maintaining control or oversight of the legitimate practice of the occupation;" also a body acting "to safeguard the public interest" organizations which "represent the interest of the professional practitioners," and so "act to maintain their own privileged and powerful position as a controlling body."

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula. Number is enough for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadart:

There are three type organisaitons in Turkey which are producer union, cooperative and association. There should be minimum 16 fish farmer for establising producer union in the city. There should be minimum 7 fisherman or fish farmer who are living in the tawn or city at least for 5 years for establishing fish farming cooperative.

National level:

Vulnerable	≤33%	≥66% Strong
Fish farmers with member of professional organisaiton	Fish farmers with member of professional organisaiton	Fish farmers with member of professional organisaiton

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be directly collected from Ministry of Food Agriculture and Livestock, Central Union of Aquaculture Produces and Associaitons.

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 1: Contribute to food security and healthy nutritional needs		
Criteria : P1C2- Accessibility for local consumers		
Indicator : N^{o} 7- Self seafood consumption per capita		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Term generally used in seafood to describe the quantity of national fish production in terms of live-weight and total fish consumption. In this case some reference could be made to the info of the output of FAO the State of World Fisheries and Aquaculture 2008,Part 4: Constraints on growth in the aquaculture

sector: ftp://ftp.fao.org/docrep/fao/011/i0250e/i0250e.pdf and UNEP, Vital Water Graphics, Coastal and Marine Water, Economic activities: Fisheries and ecotourism: http://www.unep.org/dewa/vitalwater/jpg/0319-2-fish-protein-EN.jpg

According to 2010 data more than 90% of fisheries production in Turkey is used for self consumption. The remaining 10% is used for fish meal, fish oil and other purposes.

2. METHODOLOGY

Calculation/Formula:

Self consumption is defined as total national fisheries production. Apparent consumption is calculated as production plus imports minus export of fish or other aquatic organisms in the country.

Self-consumption (Domestic production) = (fishery production + aquaculture production) – uneaten amount (quantity of used for other purposes)

Apparent consumption = (Domestic production + imported amount) – exported amount / populationSegmentation: *Local level / National level*

Reference Values/Baseline/Standart:

World total seafood production is around 149 million ton and 60 million ton of this production is caming from aquaculture. Global fish production is increasing, thanks to aquaculture: 49 % share in 2011 in food fish.

Per capita fish consumption is 14,7 kg in the World. Per-capita aquaculture production increased from 0.9kg in 1970 to 8.6 kg in 2011. In Turkey, this amount is only 8.5 kg.

National level:

Deficient	≤10 kg	Medium	≥20 kg Strong
Per capita fish consumption	Per capita fish consumption	Per capita fish consumption	

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Food Agriculture and Livestock.

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 3: Strengthen corporate social responsibility		
Criteria : P3C1- Working conditions (hours and security)		
Indicator : N^{o} 11- Number of monthly hours currently worked by aquaculture workers		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Working time is the period of time that an individual spends at paid occupational labor. Unpaid labors such as personal housework are not considered part of the working week. Many countries regulate the work week by law, such as stipulating minimum daily rest periods, annual holidays and a maximum number of working hours per week.

Commerce: Any day (other than Sunday or legal holiday) on which legal business can be conducted. Whether Saturday is a working day or not depends on the custom or usage of the trade or jurisdiction. Law: Any day other than Sunday or gazetted or statutory holiday (http://www.businessdictionary.com/definition/working-day.html).

For people paid every two weeks, there are 26 pay periods in a year. Two weeks makes 10 business days, for a total of 260 working days, not accounting for vacation time that you take.

People commonly say there are 260 work days in a year or 2080 work hours in a year based on 52 weeks per year.

2. METHODOLOGY

Calculation/Formula:

Number of working hours per month, January 2010 through December 2012, based on a five-day, Monday through Friday week, eight hours per day, holidays with pay included.

(260 = 5wkdys/wk*52wks)

(2080=40hrs/wk*52wks/yr)

160 = 40hrs/day* 4 wks)

Reference Values/Baseline/Standart:

Normally aquaculture workers is working 6 days a week. Most of workers are working fulltime in the sector.

National level:

Deficient ≤53 hrs Medium ≥66 hrs Strong

Number of monthly hours	Number of monthly hours	Number of monthly hours

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Turkey Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security.

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 3: Strengthen corporate social responsibility		
Criteria : P3C1- Working conditions (hours and security)		
Indicator : N^{o} 11- Percentage of fish-farmers with specialized certification		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Certification is the process through which an organization grants recognition to an individual, organization, process, service, or product that meets certain established criteria.

For certification of individuals, the individuals usually have to meet eligibility requirements, pass an examination, and pay a fee. There are also usually ongoing requirements that need to be met, such as retesting or participating in a minimum number of continuing education activities.

Certification is voluntary - unlike licensure which is mandatory in order to practice in the licensed role in a given state. However, that's not to say it's not valuable - because some employers require or prefer applicants who are certified.

"certification" means that a state of affairs has been stated to be so, by means, most commonly, of a document self described as a certificate

Formal procedure by which an accredited or authorized person or agency assesses and verifies the attributes, characteristics, quality, qualification, or status of individuals or organizations, goods or services, procedures or processes, or events or situations, in accordance with established requirements or standards.

Product specification term is used in aquaculture to define an explicit set of requirements to be satisfied by a aquatic product. A technical specification may be developed privately, for example by a corporation, regulatory body, military, etc: It is usually under the umbrella of a quality management system. They can also be developed by standards organizations which often have more diverse input and usually develop voluntary standards: these might become mandatory if adopted by a government, business contract, etc**.**

2. METHODOLOGY

Calculation/Formula:

Number of working hours per month, January 2010 through December 2011, based on a five-day, Monday through Friday week, eight hours per day, holidays with pay included.

(260 = 5wkdys/wk*52wks), (2080=40hrs/wk*52wks/yr), 160 = 40hrs/day* 4 wks)

Reference Values/Baseline/Standart:

Normally aquaculture workers is working 6 days a week. Most of workers are working fulltime in the sector.

National level:

Deficient	≤53 hrs	Medium	≥66 hrs Strong
Number of monthly hours	Number of monthly hours	Number of monthly hours	

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Turkey Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security.

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 3: Strengthen corporate social responsibility		
Criteria : P3C2- Level of protection and participation to trade union.		
Indicator : N^{o} 13- Percentage of trade union members among workers		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

A trade union is an organization of employees formed on a continuous basis for the purpose of securing diverse range of benefits. It is a continuous association of wage earners for the purpose of maintaining and improving the conditions of their working lives.

The Trade Union Act 1926 defines a trade union as a combination, whether temporary or permanent, formed primarily for the purpose of regulating the relations between workmen and employers or between workmen and workmen, or between employers and employers, or for imposing restrictive condition on the conduct of any trade or business, and includes any federation of two or more trade unions.

This definition is very exhaustive as it includes associations of both the workers and employers and the federations of their associations. Here, the relationships that have been talked about are both temporary and permanent. This means it applies to temporary workers (or contractual employees) as well.

2. METHODOLOGY

Calculation/Formula:

.

Reference Values/Baseline/Standart:

National level:

Deficient ≤33% Medium ≥66 %
Strong

Percentage of trade union members	Percentage of trade union members	Percentage of trade union members

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Turkey Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security.

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 3: Strengthen corporate social responsibility		
Criteria : P3C1- Working conditions (hours and security)		
Indicator : N^{o} 12- Number of occupational accidents		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Number of occupational accident term is used in aquaculture to describe that occurs in the course of a person's employment (aquaculture activities) and is caused by the hazards that are inherent in, or are related to, it (from BusinessDictionary.com).

Number of occupational accidents is relevance with working conditions and corporation social responsibility of fish farm workers. Some reference could be made to the info of the output of WORLBANK Report on Environmental, Health, and Safety Guidelines of Aquaculture: http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/guiEHSGuidelines2007Aquaculture/$FILE/FinalAquaculture.pdf

2. METHODOLOGY

Calculation/Formula:

It is only necessary to add up the accidents numbers.

Reference Values/Baseline/Standart:

There is no specific standard for occupational accidents in aquaculture sector.

National level:

Number of occupational accidents	Number of occupational accidents	Number of occupational accidents

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Turkey Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security.

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 3: Strengthen corporate social responsibility		
Criteria : P3C3- Women's access to the industry, including salary level		
Indicator : N^{o} 14- Percentage of women fish-farmers		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Percentage of women fish farmers' term is used in aquaculture to describe that a proportion of women farmers to total fish farmers.

Percentage of women fish farmers is relevance with accessing of women to the aquaculture sector. Some references could be made to the info of the outputs of Report on Women in Norwegian Fish Farming: Development and Challenges and FAO, ALCOM, GCP/INT/436/SWE.17.

In traditional fisheries women are not usually directly involved in fishing activities, either on account of the physical strain and the long hours away from home and family, or because of social taboos, customs, and beliefs which prohibit them from boarding fishing vessels. Women are thus confined to shore-based activities, such as fish handling, processing, distribution, marketing, and net-making/mending.

In contrast, the role of women in fish farming, especially in small fish farms, has long been predominant (Yap, 1980a). Women take part in actual production in most types of aquaculture - brackishwater or freshwater fish ponds, fish pens or fish cages - whether on an extensive, semi-intensive, or intensive level on a small, medium, or large scale, and in various stages of fish farm development (planning, construction and actual operation), and from seed production to grow-out/rearing, harvesting, and post-harvest handling.

The scope and magnitude of women's participation in aquaculture production in Asia are influenced to a large extent by the level of aquaculture technology in a particular country vis-a-vis the role and status of women in that society. For example, China, Thailand, and the Philippines, with their high literacy rates and their comparatively liberal value systems, boast of large pools of trained and skilled women fish farmers, technicians, extension workers, and professionals who are directly or indirectly involved in various capacities in fish production through aquaculture.

2. METHODOLOGY

Calculation/Formula:

.Percentage of women fish farm = number of women fish farmer X 100 / total fish farmer number

Reference Values/Baseline/Standart:

National level:

Deficient	≤33%	Medium	≥66 % Strong
Percentage of women	Percentage of women	Percentage of women	

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Turkey Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security, Turkish Central Union of Fish Farmers, Ministry of Food Agriculture and Livestock .

INDICATOR METHODOLOGY SHEET/SOCIAl DIMENSION/APPLICABLE INDICATOR

Principle 2: Strengthen the role of the Producer Organizations and NGO's to improve image of aquaculture, social awareness and responsibilities		
Criteria : P2C1- Average salary levels		
Indicator : N° 5- Minimum wage of employees compared to national minimum wage		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

A minimum wage is the lowest hourly, daily or monthly remuneration that employers may legally pay to workers. Equivalently, it is the lowest wage at which workers may sell their labour. Although minimum wage laws are in effect in a great many jurisdictions, there are differences of opinion about the benefits and drawbacks of a minimum wage. Supporters of the minimum wage say that it increases the standard of

living of workers, reduces poverty, and forces businesses to be more efficient. Opponents say that if it is high enough to be effective, it increases unemployment, particularly among workers with very low productivity due to inexperience or handicap, thereby harming lesser skilled workers to the benefit of better skilled workers.

The minimum wage has a strong social appeal, rooted in concern about the ability of markets to provide income equity for the least able members of the work force. For some people,[who?] the obvious solution to this concern is to redefine the wage structure politically to achieve a socially preferable distribution of income. Thus, minimum wage laws have usually been judged against the criterion of reducing poverty.

Although the goals of the minimum wage are widely accepted as proper, there is great disagreement as to whether the minimum wage is effective in attaining its goals. From the time of their introduction, minimum wage laws have been highly controversial politically, and have received much less support from economists than from the general public. Despite decades of experience and economic research, debates about the costs and benefits of minimum wages continue today

2. METHODOLOGY

Calculation/Formula:

There is no need any kind of calculation to compare with minimum wage of employees and national minimum wage. In case of Turkey, minimum wage of fish farming employees is higher than national minimum wage.

Reference Values/Baseline/Standart:

National level:

Deficient	≤660 TL	Medium	≥800 TL Strong
Minimum wage of employees	Minimum wage of employees	Minimum wage of employees	

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

National level, normally this indicator is well known by responsible authorities, decision makers and scientists. Turkey Data can be directly collected from Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security.

3.4. Governance Dimension

By

Hayri DENIZ

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 1: Promote participation in decision making process		
Criteria : P2C5- Level of management and regional planning		
Indicator : N^{o} 21- Existence of ICZM plan for coastal areas, including aquaculture		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Integrated coastal zone management (ICZM) or Integrated coastal management (ICM) is a process for the management of the coast using an integrated approach, regarding all aspects of the coastal zone, including geographical and political boundaries, in an attempt to achieve sustainability.

This concept was born in 1992 during the Earth Summit of Rio de Janeiro. The policy regarding ICZM is set out in the proceedings of the summit within Agenda 21, Chapter 17.

The European Commission defines the ICZM as follows:

ICZM is a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones. It covers the full cycle of information collection, planning (in its broadest sense), decision making, management and monitoring of implementation. ICZM uses the informed participation and cooperation of all stakeholders to assess the societal goals in a given coastal area, and to take actions towards meeting these objectives. ICZM seeks, over the long-term, to balance environmental, economic, social, cultural and recreational objectives, all within the limits set by natural dynamics. 'Integrated' in ICZM refers to the integration of objectives and also to the integration of the many instruments needed to meet these objectives. It means integration of all relevant policy areas, sectors, and levels of administration. It means integration of the terrestrial and marine components of the target territory, in both time and space.

To further understand the idea of ICZM several aspects can be defined and further explained. The coastal zone, the concept of sustainability and the term integration all within a coastal management context can be individually defined, while the expectations and framework of ICZM can be further explained. This entry uses the example of the New Zealand national framework to illustrate ICZM.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

There is no specific referance value or standart. It can be useful to compare km of coastline which are alredy existing ICZM plans and km of coastlines which are not under the ICZM plan yet.

National level:

Vulnerable	≤33%	Enough	≥66% Strong
Existence of ICZM plan for coastal areas	Existence of ICZM plan for coastal areas	Existence of ICZM plan for coastal areas	

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be directly collected from Ministry of Food Agriculture and Livestock and Ministry of Environment and Urban Planning.

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle : P1 Strengthen integration of aquaculture in local development		
Criteria : P1C3- Level of contribution to local employment and to poverty alleviation		
Indicator : N^{o} 3- Number of workers (direct and indirect)		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Term is used in aquaculture to describe the number of professional associations are a non-profit organizations seeking to further a particular profession, the interests of individuals engaged in that profession, and the public interest (from Wikipedia, the Free Encyclopedia)

The roles of these professional associations have been variously defined: "A group of people in a learned occupation who are entrusted with maintaining control or oversight of the legitimate practice of the

occupation;" also a body acting "to safeguard the public interest" organizations which "represent the interest of the professional practitioners," and so "act to maintain their own privileged and powerful position as a controlling body."

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula. Number is enough for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

There are three type organisaitons in Turkey which are producer union, cooperative and association. There should be minimum 16 fish farmer for establising producer union in the city. There should be minimum 7 fisherman or fish farmer who are living in the tawn or city at least for 5 years for establishing fish farming cooperative.

National level:

Vulnerable	≤33%	≥66% Strong
Fish farmers with member of professional organisaiton	Fish farmers with member of professional organisaiton	Fish farmers with member of professional organisaiton

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock, Central Union of Aquaculture Produces and Associaitons, Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security. .

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 2: Promote participation in decision making process		
Criteria : P2C3- Level of participation		
Indicator : N^{o} 16- Number of fish-farmers taking part in decision making process		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Decision making can be regarded as the mental processes (cognitive process) resulting in the selection of a course of action among several alternative scenarios. Every decision making process produces a final choice. The output can be an action or an opinion of choice.

Quite literally, organizations operate by people making decisions. A manager plans, organizes, staffs, leads, and controls her team by executing decisions. The effectiveness and quality of those decisions determine how successful a manager will be.

Authorities are constantly called upon to make decisions in order to solve problems. Decision making and problem solving are ongoing processes of evaluating situations or problems, considering alternatives, making choices, and following them up with the necessary actions. Sometimes the decision-making process is extremely short, and mental reflection is essentially instantaneous. In other situations, the process can drag on for weeks or even months. The entire decision-making process is dependent upon the right information being available to the right people at the right times.

For instance, there is Task Force on fisheries and aquaculture under the Ministry of Food Agriculture and Livestock in Turkey. All stakeholders representatives are member of this Task Force and they have been taking part in decision making process.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula. Number is enough for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Indicator is not clear enough to evaluate perfectly by using reference values/baselines were visualized by "Traffic Light" approach for ease interpretation of results and patterns of development towards sustainability. In case of Turkey, there are aproximetally 2000 fish farms, 16 fish farmer union and one central fish farmer union. Farmers can participare directly to decision making process or unions or central union can represent them in this process. So, this indicator should be more concrete.

National level:

Number of fish-farmers taking part in decision making process	Number of fish-farmers taking part in decision making process	Number of fish-farmers taking part in decision making process

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock, Central Union of Aquaculture Produces and Associaitons, Turkish Statistical Institute (TurkStat) and Ministry of Labor and Social Security.

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 3: Strengthen research, information systems and extension services		
Criteria : P3C1- Importance of research and training in aquaculture		
Indicator : N^{o} 22- Existence of funds for research and training		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

A sum of money or other resources set aside for a research and treaining in aquaculture or accounting entity for recording expenditures and revenues associated with research and treaining in aquaculture.

Unrestricted expendable operating funds - This fund accounts for the costs of instruction and research (other than sponsored or contract research)…

Restricted expendable sponsored research funds - This information accounts for all research activities and contract research funded from restricted sources such as government, private industry and donors.

In accordance with the definitions of funds in the consolidated financial statements, the classification of accounts as research or operating is based on the terms of funding rather than the type of expenses incurred. The following factors, which may be present in differing degrees, should be considered when determining if funding is research or operating

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula. Knowing of amount for research and training is enough for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Because of the complexity at the point of expenditure in universities and institutes research funding arrangements, it is difficult to assess in a definitive way what might be an optimal funding level. It is possible though to propose a revised funding model with a fair and clear rationale for raising research block grants by around 50% per annum.

National level:

Vulnerable	≤33%	≥66% Strong
Existence of funds for research and training	Existence of funds for research and training	Existence of funds for research and training

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock, Central Union of Aquaculture Producers and Associaitons, Turkish Statistical Institute (TurkStat).

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INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 2: Promote participation in decision making process		
Criteria : P2C5- Level of management and regional planning		
Indicator : N^{o} 20- Number of new sites created for aquaculture		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

According to the FAO, aquaculture "is understood to mean the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated."

Aquaculture site is an area zoned specifically to allow for fish farms – no other activities will be allowed if it is not inside an this area.

Aquaculture sites allow countries to manage and balance some of the competing demands for water space - for example, the sheltered waters needed for marine farms are also popular as anchorages. Once an aquaculture sites is established, other activities will only be allowed inside it if they are compatible with aquaculture.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula. Only number of new sites which are created for aquaculture is enough for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Because of the complexity at the point of expenditure in universities and institutes research funding arrangements, it is difficult to assess in a definitive way what might be an optimal funding level. It is possible though to propose a revised funding model with a fair and clear rationale for raising research block grants by around 50% per annum.

National level:

Vulnerable	≤33%	≥66% Strong
Supply rate to demand of new sites	Supply rate to demand of new sites	Supply rate to demand of new sites

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock and Central Union of Aquaculture Producers and Associaiton.

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 2: Promote participation in decision making process		
Criteria : P2C1- Level of understanding in the industry		
Indicator : N^{o} 11- Percentage of fish-farmers and technicians who know the regulations		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Regulation is broadly defined as imposition of rules by government, backed by the use of penalties that are intended specifically to modify the economic behaviour of individuals and firms in the private sector. Various regulatory instruments or targets exist.

In this context, it mean that how many fish farmers aware from regulation concerning aquaculture. In Turkey, there are many regulations on aquaculture such as Fisheries Low, Environmental Low,

Aquaculture Regulation, EIA Regulation, Renting Regulation, Site Selection Regulation, Fish Farm Monitoring Regulation.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula. Knowing of percentage of fish farmers who are aware from regulations is enough for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Tehere are 1.935 fish farms in Turkey in 2010. It is easy to assess in a definitive way what might be an optimal awareness level. It is possible though to propose 50 % as an optimum awareness level if regulations are known by 1.000 fish farmers..

National level:

Vulnerable ≤33% optimum ≥66% Strong

Percentage of fish-farmers and technicians who know the regulations	Percentage of fish-farmers and technicians who know the regulations	Percentage of fish-farmers and technicians who know the regulations

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock, Central Union of Aquaculture Producers and Associaitons, Turkish Statistical Institute (TurkStat).

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INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 4: Strengthen institutional capacities in relation with sustainable development		
Criteria : P4C1- Level of national recognation of sustainable development		
Indicator : N^{o} 27- Existence of a national aquaculture strategy plans		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

The strategic action plans outline areas where efforts are required to improve public governance of aquaculture and private operations. Effective, well-communicated governance enhances public confidence in government oversight of industry activities, leading to an improved social licence-and in turn, to increased investor confidence in aquaculture, which will stimulate responsible and sustainable growth that creates economic prosperity.

Turkey has national marine aquaculture strategy plans.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Tehere is no need any value, baseline or standart.

National level:

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock and Ministry of Environment and Urban Planning..

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INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 4: Strengthen institutional capacities in relation with sustainable development		
Criteria : P4C1- Level of national recognation of sustainable development		
Indicator : N^{o} 28- Existence of rules and regulations for sustainable development		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Sustainable development is a pattern of resource use, that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. The term was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."

Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity. As early as the 1970s "sustainability" was employed to describe an economy

"in equilibrium with basic ecological support systems." Ecologists have pointed to The Limits to Growth, and presented the alternative of a "steady state economy" in order to address environmental concerns.

The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability.

All definitions of sustainable development require that we see the world as a system-a system that connects space; and a system that connects time.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Tehere is no need any value, baseline or standart.

National level:

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock and Ministry of Environment and Urban Planning.

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 4: Strengthen institutional capacities in relation with sustainable development		
Criteria : P4C1- Level of national recognition of sustainable development		
Indicator : N^{o} 28- Existence of rules and regulations for sustainable development		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Sustainable development is a pattern of resource use, that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. The term was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."

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"in equilibrium with basic ecological support systems." Ecologists have pointed to The Limits to Growth, and presented the alternative of a "steady state economy" in order to address environmental concerns.

The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability.

All definitions of sustainable development require that we see the world as a system-a system that connects space; and a system that connects time.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Tehere is no need any value, baseline or standart.

National level:

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock and Ministry of Environment and Urban Planning..

INDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 1: Strengthen integration of aquaculture in local development		
Criteria : P1C6- Capacity of aquaculture to improve environmental monitoring capacity		
Indicator : N^{o} 8- Existence of subsidies for aquaculture ecologic services		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

Humankind benefits from a multitude of resources and processes that are supplied by natural ecosystems. Collectively, these benefits are known as ecosystem services and include products like clean drinking water and processes such as the decomposition of wastes. While scientists and environmentalists have discussed ecosystem services for decades, these services were popularized and their definitions formalized by the United Nations 2004 Millennium Ecosystem Assessment (MEA), a four-year study involving more than 1,300 scientists worldwide. This grouped ecosystem services into four broad categories: provisioning, such as the production of food and water; regulating, such as the control of

climate and disease; supporting, such as nutrient cycles and crop pollination; and cultural, such as spiritual and recreational benefits.

As human populations grow, so do the resource demands imposed on ecosystems and the impacts of our global footprint. Natural resources are not invulnerable and infinitely available. The environmental impacts of anthropogenic actions, which are processes or materials derived from human activities, are becoming more apparent – air and water quality are increasingly compromised, oceans are being overfished, pests and diseases are extending beyond their historical boundaries, and deforestation is exacerbating flooding downstream. It has been reported that approximately 40-50% of Earth's ice-free land surface has been heavily transformed or degraded by anthropogenic activities, 66% of marine fisheries are either overexploited or at their limit, atmospheric CO^2 has increased more than 30% since the advent of industrialization, and nearly 25% of Earth's bird species have gone extinct in the last two thousand years. Society is increasingly becoming aware that ecosystem services are not only limited, but also that they are threatened by human activities. The need to better consider long-term ecosystem health and its role in enabling human habitation and economic activity is urgent. To help inform decision-makers, many ecosystem services are being assigned economic values, often based on the cost of replacement with anthropogenic alternatives. The ongoing challenge of prescribing economic value to nature, for example through biodiversity banking, is prompting transdisciplinary shifts in how we recognize and manage the environment, social responsibility, business opportunities, and our future as a species.

There is no direct payment for aquaculture ecologic services in Turkey. Turkish Government has been supporting to the aquaculture ecologic services. For instance, fish farmers are paying for rental rate less than conventinal farmers if they have any certificate of ISO 14000, ISO 9000, ISO 19011, HACCP or Environmental Treatment Systems.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula for evaluation.

Segmentation: *Local level / National level*

Reference Values/Baseline/Stanadard:

Teere is no need any value, baseline or standart.

National level:

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock and Ministry of Environment and Urban Planning. .

I

NDICATOR METHODOLOGY SHEET/GOVERNANCE DIMENSION/APPLICABLE INDICATOR

Principle 4: Strengthen institutional capacities in relation with sustainable development t		
Criteria : P4C2- Level of involvement of the State in the implementation of sustainable development		
Indicator : N° 31- Number of license for aquaculture		
Applicable at:	✓ Local level	✓ National level

1. DEFINITION

The license is for any person who owns or operates an aquaculture facility for the purpose of possession, production.

In case of Turkey, the license is a certificate issued by the Ministerial central organization for those engaged in the aquaculture production. This certificate is given by Aquaculture Departmet, DG for Fisheries and aquaculture of Ministry of Food Agriculture and Livestock.

In Turkey, there are 1.935 fish farms in 2010 and 1.587 fish farms are located in inland water and 348 fish farms are operating in marine water. According to the Aquaculture Regulation, every fish farm has to tave aquaculture license in Turkey. Now, there are 1.935 aquaculture licenses which are given by Ministry of Food Agriculture and Livestock.

2. METHODOLOGY

Calculation/Formula:

There is no need any calculation or formula for evaluation. Only number is enough. It can be better to use new application number or license numbers which are nively given in past one year.

Segmentation: *Local level / National level*

Reference Values/Baseline/Staadard:

Tehere is no need any value, baseline or standart.

Implementation frequency:

The trend can be followed on annual bases.

3. SOURCES of DATA and INFORMATION

Data can be collected from Ministry of Food Agriculture and Livestock.

APEENDIX-1

Guidelines for the Focus Group Discussions

Objectives and Tasks of Focus Group Discussions (For each dimension)

1. Review the indicator evaluation sheets for candidate indicators selected in Turkish Pilot Action-I (Environmental, economic, social and governance).

2. Evaluate and comment on strengths and weaknesses of selected candidate indicators for applicability based on:

    a. Context-specific indicator quality attributes

- Scientific validity of indicator
- Influence of indicator on policy formulation and decision-making towards sustainability
- Existence of reference values
- Practicality

And

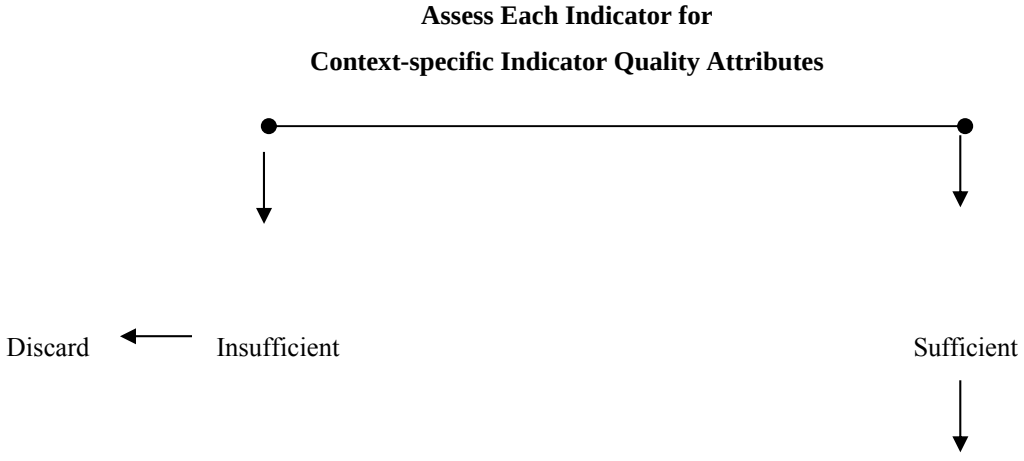
b. Data-specific indicator quality attributes
   - Availability in suitable format for supporting the indicator
   - Appropriateness in temporal and spatial scales
   - Currency
   - Scientific validity
   - National capabilities to implement data collection schemes to support the indicator
   - Cost-Effectiveness and affordability of data collection scheme to support indicator

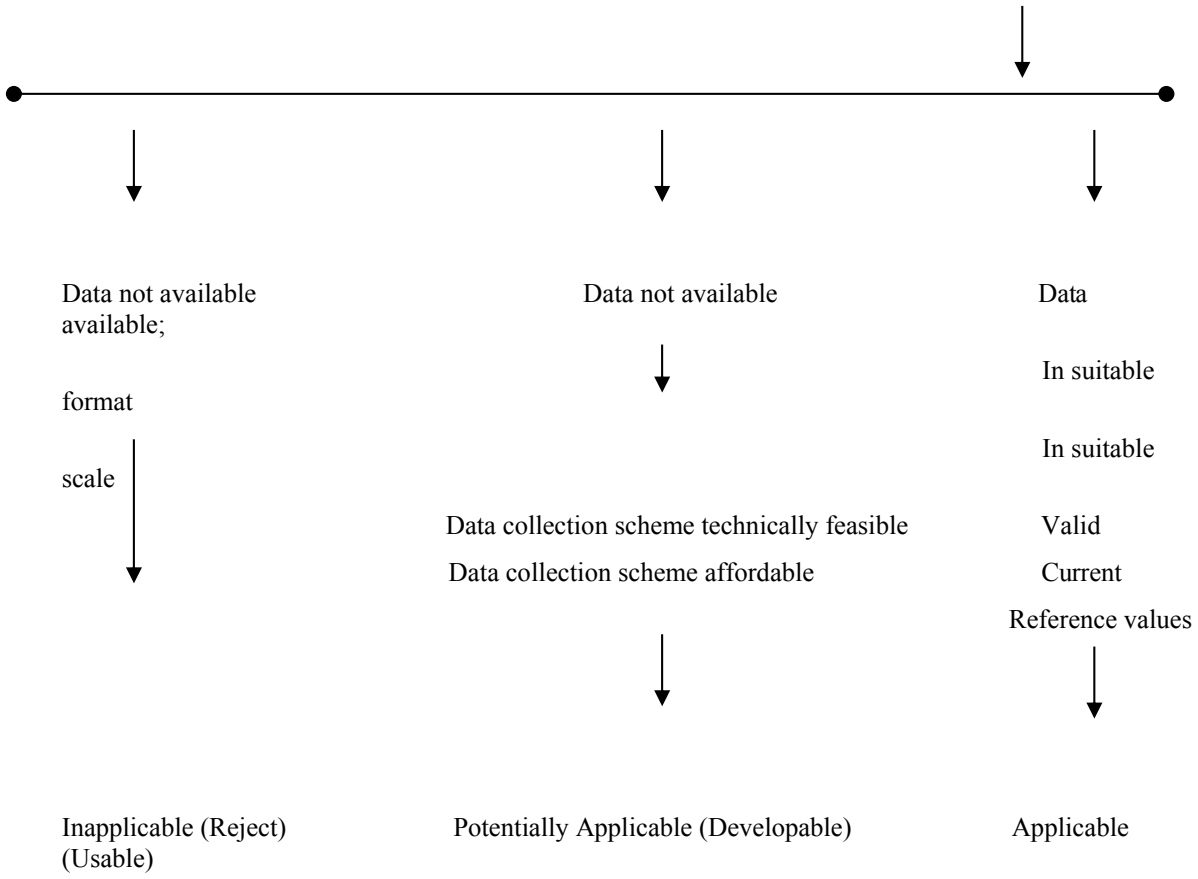
3. Refine and classify the candidate indicators according to their quality attributes as "Applicable (usable)", "Potentially applicable (developable)" or "inapplicable (rejected)" as outlined in the flowchart.

4. Propose new indicators and discuss any additional conceptual or methodological matter which would contribute to modification and improvement in indicator development, selection and assessment processes.

5. Finalize the list of applicable/Potential/new indicators for application at enterprise and/or national level in Turkey.

6. Produce a report on outcome of focus-group consultation including recommendations for presentation at end of the meeting for joint group discussions.





Flowchart for Assessing Applicability of Indicators during Focus-Group Discussions

APPENDIX-2

Indicator Evaluation Sheet

Dimension: Economic

Principle : P3-Strengthen Financial Management of Enterprises
Criteria : P3C3-Level of Financial Strength
Indicator : N^{o} 40-Current Ratio

A. CONTEXT-SPECIFIC ASPECTS

1. Rationale and Objective of Indicator

(*Specify the logic and conceptual justification behind this indictor and its relation with development of sustainable aquaculture; how this indictor will contribute to decision-making and management towards sustainable aquaculture)*

2. Methodology

Calculation/Formula

(*Specify the method, approach or formula to compute this indicator including segmentation, if the case*)

Reference Values

(*Specify reference values, standards or baselines if any available or developable through 'Traffic Ligth' approach*).

Level of Implementation

(*Specify the level of application, e.g. at Farm/National level*)

Measurement Frequency

(*Comment on time interval necessary for monitoring the trend)*

B. DATA-SPECIFIC ASPECTS

1. Data Availability and Quality

(*Discuss data availability with regard to various quality attributes, e.g. scientific validity and reliability of measurements, temporal and spatial scale of data, currency-up datedness, scale used to measure data*)

2. Sources of Data and Information

(*Comment on where and how data can be readily obtained, if data is not already available comment on feasibility of data collection schemes with regard to national capabilities and budgetary aspects)*

APPENDIX-3

List of participants

	Institution / Company	Mobile	E-mail
Ahmet DALLI	Gıda Tarım ve Hayvancılık İl Müd.	0536 275 12 01	dalli_ahmet@mynet.com
Ali TÜRKER	MUğla Üniv.,Su Ürün. Fak.	0506 751 95 38	aliturker@mu.edu.tr
Assistant Prof. Dr. Güzel YÜCEL GIER	Dokuz Eylül Üniversitesi, Deniz Bilimleri ve Teknolojisi Enstitüsü	0537 385 12 07	yucel.gier@deu.edu.tr
Prof. Dr. Ferit RAD	Mersin Üniversitesi Su Ürünleri Fakültesi	0536 838 33 22	frad@mersin.edu.tr
Necip EMRE	Bağcı Balık A.Ş.	0506 448 06 05	necip.emre@bagci.com.tr

Kadir Burçin ŞENAY	Mersin Üniversitesi Su Ürünleri Fakültesi	0505 722 13 84	kbsenay@hotmail.com
Faruk Nafiz SEVİS	Bağcı Balık A.Ş.	0530 201 94 49	f.sevis@bagci.com.tr
Associate Prof. Dr. Kenan GÜLLÜ	Muğla Üniversitesi Su Ürünleri Fakültesi	0535 978 66 07	kenangullu@mu.edu.tr
Prof. Dr. Taçnur BAYGAR	Muğla Üniversitesi Su Ürünleri Fakültesi	0542 597 39 95	baygar@mu.edu.tr
Tayfun YÜKSEL	AGROMEY GIDA	0530 290 69 12	tayfun.yuksel@agromey.com
Ahmet ERSOY	AGROMEY GIDA	0507 739 45 71	ahmetersoy83@gmail.com
Assistant Prof. Dr. Hacı KURT	Mersin Üniversitesi, İİBF	0535 838 65 06	haci1963@hotmail.com
Assistant Prof. Dr. Erkan AKTAŞ	Mersin Üniversitesi, İİBF	0530 560 58 03	erkanaktas@mersin.edu.tr
Associate Prof. Dr. Önder YILDIRIM	Muğla Üniversitesi Su Ürünleri Fakültesi	0542 321 07 48	onderyildirim@mu.edu.tr
Ramazan KOPUZ	Uğurlu Balık	0532 273 58 72	
Melih TEKİN	Poseyidon Su Ürünleri	0532 384 11 64	melihposeyidon@gmail.com
Zafer KUŞ	Ekinsu Deniz Ürünleri	0507 372 85 85	zafer.kus@hotmail.com
Orhan ÜNÇEL	Defne-Tur Su Ürünleri	0532 220 48 04	defne_tur@hotmail.com
Mehmet ÇATALKAYA	Muğla İl Gıda Tarım ve Hayvancılık Müd.	0533 446 60 90	m.catalkaya@mynet.com
Hayal DEMİRHAN	Muğla İl Gıda Tarım ve Hayvancılık Müd.	0533 619 92 54	hayaldemirhan@mynet.com
Tanju ÖZDEMİRDEN	Milas İlçe Gıda Tarım ve Hayvancılık Müd.	0535 337 67 30	tanjuozdemirden@hotmail.com
Cuma KAHRAMANOĞLU	Muğla İl Gıda Tarım ve Hayvancılık Müd.	0542 585 49 51	48@kkgm.gov.tr
Ali AKAY	Milas İlçe Gıda Tarım ve Hayvancılık Müd.	0532 377 99 78	
Dr. Songül TOPAL	Muğla İl Gıda Tarım ve Hayvancılık Müd.	0533 388 92 06	songultopal@hotmail.com
Faruk COŞKUN	Merkez Birliği Başkanı	0533 240 16 11	farukcoskun99@gmail.com
Öznur YILDIZ BAŞRUH	Kılıç Deniz Ürünleri A.Ş.	0533 697 17 30	oznuryildiz@kilicdeniz.com.tr
Erbil BAŞRUH	Defne-Tur Su Ürünleri	0532 542 26 95	erbasruh@superonline.com
Özden KARAKAYA	Fjord Marin	0533 724 19 36	ozden.kirkpinar@fjord-marin.com.tr
Serhat TARAKCI	Kılıç Deniz Ürünleri A.Ş.	0543 411 98 10	serhat485737@hotmail.com
Associate Prof. Dr. Ali Y. KORKUT	Ege Üniversitesi Su Ürünleri Fakültesi	0532 341 79 97	ali.korkut@ege.edu.tr

Assistant Prof. Dr. Tülin ÇOKER	Muğla Üniversitesi Su Ürünleri Fakültesi	0538 718 37 62	tulincoker@mu.edu.tr
Dr. Ertan DAĞLI	Ege Üniversitesi Su Ürünleri Fakültesi	0505 715 30 58	ertan.dagli@ege.edu.tr
Dr. Necla TÜRK	AGROMEY GIDA	0532 441 56 49	neclatrk@hotmail.com
Nadir USLU	Balıkçılık ve Su Ürünleri Gn. Müd.	0535 666 35 16	nadir.uslu@tarim.gov.tr
Binnur CEYLAN	Balıkçılık ve Su Ürünleri Gn. Müd.	0505 676 11 22	binceylan@yahoo.com
Dr. Hayri DENİZ	Balıkçılık ve Su Ürünleri Gn. Müd.	0505 831 10 93	hayri.deniz@tarim.gov.tr

APPENDIX-4

AGENDA

InDAM Project Turkish Pilot Action-II

"Indicators for Sustainable Development of Marine Aquaculture and Guidelines for their use in the Mediterranean"

Focus-Group Meeting

21-22 September 2011

Muğla/Turkey

21 September 2011, Wednesday

9:00-9:30	Registration
9:30-9:45	Welcome and opening of the meeting
9:45-10:00	Adoption of agenda
10:00- 11.00	Background information on InDAM project and Turkish Pilot Action-l (Presentation of InDAM, conceptual and methodological aspects of indicator selection process in Turkish Pilot Action-I and review of main outcomes)
11:00-11:15	Coffee Break
11:15-13:00	Background information on InDAM project and Turkish Pilot Action-l (*Continued*) - Presentation of selected indicators for environmental dimension - Presentation of selected indicators for economic dimension - Presentation of selected indicators for social and governance dimension
13:00 -14:00	Lunch break
14:00 -14:30	Introduction of Turkish Pilot Action-II (Rational, objectives, conceptual and methodological aspects for assessment of selected indicators)
14:30- 15:00	Discussion and brainstorming on conceptual and methodological aspects
15:00-15:15	Coffee break
15:15-16.00	Arrangements of focus-group consultation for environmental, economic, social and governance dimensions of sustainability

16:00- 18:00 Focus-group discussions (Review of evaluation sheets for indicators, assessment and short-listing of indicators)

22 September 2011, Thursday

9:00-11:00 Focus group discussions (Short-listing, methodological aspects, reference values/baselines for traffic light approach) (*Continued*)

11:00-11:15 Coffee break

11:15-13:00 Presentation of outcomes of focus-group discussions by coordinators

13:00-14:00 Lunch break

14:00-15:30 Discussions on outcomes, main conclusions and recommendations of focus group consultations

15:30-15:45 Coffee break

15:45-17:00 Adoption of outcomes, main conclusions and recommendations