PART II

Special Chapter on Economic and Social Sustainability Indicators for Fisheries

Executive summary

Measurement of progress towards sustainable development goals has become an increasingly important policy focus in recent years. In the fisheries sector, the use of environmental indicators in the development of fisheries assessments and management plans has been standard practice in most OECD countries for many years. However, relatively little attention has been paid to the development of economic and social indicators that serve to assess progress on other aspects of sustainable development. In this report, a review is provided of recent developments by OECD countries and international organisations on social and economic indicators, together with a survey of the key conceptual and practical issues involved in their use at the international, national and local level.

The survey revealed that many OECD member countries place a particularly high priority on the need for social and economic indicators and have devoted considerable resources to the development of this stream of information. However, few of these initiatives have reached the stage where economic and social indicators are produced and used on a regular basis – the evolution of such indicators for fisheries is still very much in its infancy.

There is a significant degree of diversity across OECD countries regarding the key policy issues to which current efforts to develop sustainability indicators are being applied. In a number of countries the policy priority is the assessment of regional impacts of fisheries policy changes, particularly with respect to the impact on local and regional communities. Other countries are more focussed on the economic performance of their national fleets and of the various fisheries within their EEZs.

The diverse policy priorities result in a wide range of approaches to developing indicators being adopted within member countries. There is very little commonality amongst the countries with respect to frameworks and the various approaches clearly reflect the policy processes and demands faced by the individual countries. Some countries have developed measures of economic returns to their fisheries and have been able to employ them primarily in *ex post* evaluations of the performance of the sector and of management. Other countries are embarking on ambitious programs of developing objectives and targets for fisheries management based on the use of bioeconomic models. Such an approach differs from the former in that it aims to set targets and then measure progress towards those targets.

There is also a significant difference across countries with respect to both the available data and the institutional capacity to provide relevant data to support the development of sustainability indicators. However, there are benefits and costs that need to be considered when developing indicators. Obtaining data for use in indicators is not costless and there needs to be careful consideration as to whether or not there are net benefits associated with the use of the indicators for which the data are collected.

Introduction

The purpose in this paper is to provide a survey of the development and implementation of economic and social sustainability indicators in OECD countries and to review the key issues surrounding the use of such indicators. The pursuit of sustainable development as a policy objective has become increasingly important in recent years and policy makers are requiring more information on how to measure progress towards sustainable development goals. In the fisheries sector, the use of environmental indicators in the development of fisheries assessments and management plans has been standard practice in most OECD countries for many years. However, relatively little attention has been paid to the development of economic and social indicators that serve to assess progress on other aspects of sustainable development.

In recognition of this information gap, the OECD Committee for Fisheries undertook this project on economic and social sustainability indicators. The overall goal for the study is to contribute to improvement in the measurement of economic and social dimensions of sustainable development of fisheries, and where possible, relate these to the resource and environmental dimensions. The project was given additional impetus through the 2001 OECD Council at Ministerial level which asked the OECD to assist its member countries to realise their sustainable development objectives, and to report on progress through, amongst other things, the development of appropriate indicators.

This paper does not seek to provide a definitive list of indicators for use by OECD countries. Nor does it seek to be prescriptive about the type of framework that should be employed or indicators that should be developed. Rather, it provides a review of the initiatives that have been undertaken by OECD countries and international organisations (such as the FAO) in this area. It also provides a survey of the key conceptual and practical issues involved in the use of economic and social indicators at the international, national and local level. In this way, OECD and non-OECD countries can benefit from the pooling of experiences in the development and use of indicators, adapting sustainability concepts and frameworks to their individual needs and circumstances.

1. Indicators of sustainable development

In considering the concept of indicators of sustainable development, a necessary first step is to define what is meant by sustainable development in the context of fisheries. Sustainable development is generally defined as being development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs. As a renewable, but potentially depletable, resource, fisheries can be regarded as being a good example of what sustainable development is ideally about. Sound stewardship of fish stocks will generally result in the environmental conditions for sustainable development being met. However, recent experience has demonstrated that fish stocks are vulnerable to overfishing and depletion. Of 441 marine stocks fished worldwide, more than 28% are estimated to be overfished (18%), depleted (9%) or recovering (1%), while about 47% are fully exploited.

There has been an increasing interest in recent years in the measurement of progress toward sustainable development across all sectors of the economy. The concept of sustainable development, which seeks to incorporate environmental, economic and social considerations into policy making, poses a significant challenge for measurement. Trying to adequately incorporate these issues into a readily understood framework has proved to be difficult,

requiring significant efforts to enhance existing concepts and to develop new approaches. While most OECD countries have a wide range of statistics on the environmental, economic and social status of their societies, these have generally not yet been integrated into a single coherent framework.

The fisheries sector is no exception. This sector depends primarily on the sustainable exploitation of fish stocks, but it has become increasingly recognised that decisions on the use of fish resources cannot be made in isolation from social and economic considerations. Knowledge about fishing actrivities and other pressures on marine resources is critical to ensuring sustainable management of fisheries and to contributing to the broader goal of sustainable development.

What are indicators?

Indicators are data or combination of data collected and processed for a clearly defined analytical or policy purpose. That purpose should be explicitly specified and taken into account when interpreting the value of an indicator. Fisheries indicators should provide practical and cost-effective means for the evaluation of the state and the development of fisheries systems and the effects that policy changes have on those systems.

For the indicators to be effective and workable in assessing the economic and social performance of fisheries, they should:

1. Have a clear policy relevance and in particular:
   - provide balanced coverage of some of the key issues of common concern to OECD countries, and reflect changes over time;
   - be easy to interpret (that is, movements in each indicator should have clear link to overall sustainability);
   - allow comparisons across countries;
   - lend themselves to being adapted to different national contexts, analysed at different levels of aggregation and linked to more detailed indicator sets.
2. Be analytically sound in technical and scientific terms, based on internationally accepted standards and broadly accepted by stakeholders.
3. Be based on data that are available, of known quality and regularly updated (OECD, 2001c, p. 71).

Most effort to date has been on developing indicators related to the ecological sustainability of fisheries. There is a large and established literature on the use of a wide range of indicators to assess the relative abundance and health of individual fish stocks. This is done through such concepts as target and limit reference points, biomass indexes, fishing mortality and effort measures, and so on (see, for example, Hilborn and Walters 1992; Caddy and Mahon 1995). This work is largely based on a range of increasingly complex population models and is often used to inform fisheries policy and decision makers when setting management targets for fisheries. To a large extent, these indicators have stayed in the preserve of specialists and have not generally had much exposure or impact in the public arena. More often, it is the headline statistics on the overall health of specific fish stocks that is used to communicate the state of fisheries.

In the meantime, relatively little attention has been paid to the set of potential indicators that could be used to assess the economic and social aspects of fisheries and the interaction with the pursuit of sustainable development objectives. The growing demand for social and economic indicators from policy makers is a result of this perceived imbalance.

What are indicators used for?

The main purpose in developing a set of sustainability indicators is to assist in assessing the performance of fisheries policy and management and to stimulate action to better pursue sustainability objectives. This can occur in a number of areas. For example, indicators can be used for: *ex post* evaluations of the impacts of management initiatives; assessment of progress towards medium and/or long term objectives; and assessment of the impacts of fisheries.

They can also enhance communication, transparency, effectiveness and accountability in fisheries management. In this regard, indicators can be developed and reported at various levels of aggregation – international, national, regional and local levels. Many of the environmental indicators for fisheries referred to above are focussed on the fishery level. Other aggregates that are regularly reported, such as the contribution of fisheries to exports, are reported at a national level. Yet others relate to fisheries that are managed regionally as straddling and/or highly migratory stocks.

The range of purposes for which indicators are currently used within OECD countries is discussed later in the survey.

Frameworks for measurement

It is clearly necessary to ensure that the linkages between objectives, indicators and outcomes be identified within a well-founded framework. Frameworks are important for linking indicators to analytical questions and policy issues. As noted in OECD (2001c), there is a range of frameworks currently in use in the various areas of sustainable development, with the choice of framework varying according to the purpose of the measurement. Two broad types of frameworks can be identified: accounting and analytical frameworks.

Accounting frameworks

National accounts have traditionally been the primary measurement framework for economic policy making. These accounts record the economic transactions of a country in monetary terms, encompassing economic production, consumption and savings, assets and productivity, employment and so on. However, it is recognised that traditional national accounts do not incorporate environmental issues appropriately, nor are they amenable to the measurement of sustainable development. Much recent work has considered how to extend the national accounts to take account of environmental and social issues. This is generally done by augmenting existing accounts with other relevant accounts, usually linked by monetary measures.

One of the most common extensions is the use of environmental or natural resource accounts. In brief, these accounts measure the quantitative changes in stocks and flows for different environmental assets. They are generally presented in terms of the supply of resources, matched against the demand for these resources from society. The accounts are usually compiled in physical units and then converted to monetary terms. Many OECD countries have developed resource accounts for different types of assets, including water, forests and mineral resources. There have been few attempts to develop resource accounts for fisheries, with the publication of a fish account by Australia being the most recent example (Australian Bureau of Statistics 1999). Some of the key issues highlighted in the Australian exercise were the problem in developing robust estimates of fish stocks and the difficulty in obtaining reliable valuation estimates for stocks and flows. Despite these concerns, such fish accounts provide useful information on the physical flows of fish resources.

In relation to the social aspects of sustainable development, there have been significant advances in recent years in analysing the interactions between the social and economic spheres, particularly in the areas of income distribution, household consumption patterns and employment. Work has been underway for some time expanding the national accounting framework to encompass social capital concepts and measurement. However, it is recognised that there is much work to be done to link such efforts to a broader sustainable development framework (OECD 2001c, p. 63).

Analytical frameworks

Analytical frameworks supplement the accounting frameworks by targeting the development and interpretation of indicators more directly to policy issues. One such framework that has been developed and used extensively within OECD, and adapted by other international organisations, is the pressure-state-response (PSR) framework (see OECD 1998, 2000b, 2001c). In broad terms, the PSR framework aims to identify the *pressure* on the environment from human and economic activities, which lead to changes in the *state* or environmental conditions that prevail as a result of that pressure, and may provoke *responses* by society to change the pressures and the state of the environment (Box II.1). This framework has primarily been used for analysing the environmental aspects of policy development rather than for the analysis of social or economic aspects of sustainable development. The main advantage of the PSR framework is that it provides a means of selecting and organising indicators in a coherent way that is generally useful and understood by decision makers and the public. However, a key concern with the use of the PSR framework is that it is primarily a process for describing linkages between human activities and the environment, and does not have a sound theoretical underpinning that can be readily applied to assessing progress towards sustainable development.

The Resource-Outcome Indicator approach recently developed by the OECD seeks to overcome this drawback of the PSR framework by building on the generally accepted view that sustainable development is development that satisfies current needs without compromising the needs of future generations to satisfy theirs (OECD 2001c, pp. 64-70). In brief, this approach identifies a necessary condition for sustainable development as the maintenance of assets, broadly defined to include environmental, economic and social assets, over time as these assets provide the means through which societal needs can be satisfied both today and in the future. Such condition poses interesting questions about the substitutability of the different forms of assets both within and between generations, but has the main advantage that it requires the explicit recognition of the importance of maintaining the portfolio of assets over time.

In terms of measurement, this approach requires that indicators be developed on how well the range of assets is preserved (resource indicators) and how well current needs are being satisfied (outcome indicators). In essence, it links the importance of extending national balance sheets to include a broad range of assets with the maintenance of these assets in order to provide for future well-being. The approach was used in the development of a set of sustainable development indicators by the OECD in 2001 (OECD 2001c). While fisheries were not included in the indicative list of resource indicators presented in that report (due largely to methodological concerns with measurement), it is clear that such an approach merits further attention in relation to fisheries.

The resource-outcome approach is also being pursued in a number of OECD countries, generally at the level of pilot studies. In Canada, for example, the development of a set of

Box II.1. **Overview of the PSR framework for sustainable development indicators**

The PSR framework defines three types of indicator:

Pressure – These indicators provide information about the pressure that is being applied on some aspect of the fisheries sustainability system. It can be difficult to determine whether a level of pressure is acceptable or whether it is too high, unless information is also available on the state of the environment. Therefore these indicators generally need to be read alongside the state indicators. However, variations in pressure indicators can be early warnings of problems before they cause a change in the state indicators.

State – These indicators report on the current state of some aspect of the fisheries sustainability system. They provide information on where the system stands at the moment it is observed. The observation of a time series of one indicator indicates trends in the state of the system.

Response – These indicators report on what action decision-makers and managers are taking in response to signals they receive on the state of the fisheries sustainability system or, very often, in response to pressures from stakeholders. If indicators suggest that the state of the system is satisfactory then no action may be required. These indicators form an important part of the feedback loop into the management system.

To be meaningfully interpreted, the three types of indicator should be directly related. For instance the indicator of pressure (*e.g.* fishing rate) should be accompanied by a measure of impact of such pressure (*i.e.* stock level) and a measure of response to such pressure (regulation of fishing pressure or removals). Ideally, a model should be available on how the three are related. PSR indicators should be developed that are dynamic and therefore capture both the direction and rate of change as well as static measures of the system. For ease of presentation and understanding, indicators could be presented in a sustainability "scorecard" or "dashboard" format at some appropriate periodicity, perhaps annually.

Examples of PSR indicators for fisheries are given in the table. Many of these indicators can be applied to more than one of the scales identified – global, regional, national, sub-national and local. Some indicators can also serve as more than one of the three types of indicator – catch, for instance, could serve as both a pressure and a state indicator.

Source: FAO, 1999.

environmental and sustainable development indicators (ESDI) is framed by the goal of maintaining future economic options (Smith and Choury 2002). The ESDI initiative focuses on maintaining productive capital which is broadly defined to include produced capital (such as buildings and machinery), human capital, as well as natural capital. The ESDI's capital approach to indicators recognises that different types of capital can substitute for one another. The use of more machines and less labour is a typical substitution of produced capital for human capita. In some cases, produced capital can substitute for natural capital (for example, the use of fibre optics to replace copper). But it is also recognised that there are no substitutes for some of the features of natural capital (for example, clean air and clean water).

Fisheries data and indicators

The OECD Committee for fisheries annual *Review of Fisheries in OECD Countries* (see, for example, OECD 2001d) presents statistical information on quantity and value of landings,

Table II.1. **Examples of PSR indicators**

Dimensions	Pressure	State	Response
Ecosystem (resource and environment)	Total catch Total area fished Catch/sustainable yield % *resources > target* Total effluent discharge	B/Target B F/Target F E/Target E % *TR > target* *% NTR > target* Biodiversity index Community structure Trophic structure Area of critical habitat	TAC/sustainable yield % depleted stocks rebuilding Reduction of land-based pollution User rights established User fees established
Social	Fishing effort Number of vessels Growth rate of number of fishers Unemployment rate Immigration rate Social unrest	Number of fishers Demography Number of associations % below poverty line Income and asset distribution	Unemployment assistance Support to associations Resources allocation decision
Economic	Sector unemployment Subsidies Excess fishing capacity Resource rent potential	Profitability Wages and salaries Sector employment	Economic incentives and disincentives (*e.g.* subsidies, taxes, buy-back) Command and control measures
Institutions/governance	Employment policies Absence of use of property rights	% resources assessed % with management plans % management cost recovery Rate of compliance % resources co-managed	% resources assessed Job conversion programmes Retraining programmes Number of compliance operations

B = Biomass, F = Fishing mortality, E = Exploitation rate, TR = Target resources, NTR = Non-target resources.
Source: FAO, 1999.

employment, fleet capacity, government financial transfers, aquaculture production and trade in fish and fish products. This data provides extensive information about the basic economic and social characteristics of fisheries at a national level. The collection has been underway for some years and provides a time series from which indicators related primarily to the economic aspects of fisheries can be developed.

The OECD report, *Transition to Responsible Fisheries – Economic and Policy Implications* (OECD 2000) presents the modelling approach being used for analysing a cross section of fisheries (groundfish, small pelagic and invertebrates) from OECD member countries (Australia, Canada, Germany, Iceland, Japan and New Zealand) and the results of the case studies. A further set of case studies was presented using various other analytical approaches for fisheries in the European Community, Korea, Norway, Mexico and the United States of America. The first set of case studies consisted of an annual historical, current and projected status of the fisheries with respect to biological, economic, social and administrative targets. The non-biological performance elements are shown in Table II.2.

For each of the economic, social and administrative model components in Table II.2, two or three indicators measure the performance of the fishery within the modelling framework. This approach makes it possible to compare the modelling performance with the specified policy objectives. For a further description of the modelling approach of the Transition study see *A Model Approach for Analysis of Fishery Transition* in OECD (2000c). Due to the high resource costs in maintaining such modelling frameworks, this approach has not been pursued to date within the OECD.

Table II.2. **Performance measures by model components**

Model component	Description	Performance output and specified objectives
Economic	Annual *pro forma* operating performance by harvesting gear type and processing sector; gear type performance is described for an average vessel	1. Annual profit statement 2. Annual cash calculation 3. Annual balance sheet
Social	Annual analysis of workforce demographics for harvesting and processing; annual employment and unemployment based on catch information	1. Level of employment (harvesting, processing) 2. Labour earnings
Administrative	Annual harvesting and processing administrative costs for fisheries management, fees, licenses; costs associated with administrative functions, *e.g.,* dockside monitoring, observers, quota transactions costs	1. Number of administrative personnel 2. Annual administrative costs

Source: OECD (2000c).

Environmental indicators

There has been extensive work done within the OECD in recent years in developing environmental indicators as well as efforts to link environmental indicators to sustainable development goals. The recent report on *Key Environmental Indicators* (OECD 2001a) builds on previous work and presents ten sets of key environmental indicators, including a set relating to fish resources. These indicators were primarily based on catches as a percentage of world catches and changes in total catches since 1980. In assessing the measurability concerns about indicators for fish resources, the report noted that, while catch and production data are available for most OECD countries at a significant level of detail, more work needs to be done to better reflect the composition of the landings and its trophic structure. In addition it was observed that additional efforts should be made to relate fish harvest to available fish resources.

The recent OECD work on sustainable development generated additional indicators on fish resources. The report *Towards Sustainable Development: Environmental Indicators 2001* (OECD 2001b) reported on fish consumption per capita as an indirect pressure indicator on fish resources. However, this indicator was not integrated with the existing indicators on fish catches. In a related report, *Sustainable Development – Critical Issues* (OECD 2001c), the long term trend in the price of fish meal was presented as a partial indicator of resource scarcity when discussing natural resource management in the context of sustainable development.

In May 2001, the OECD Council at Ministerial level requested that the OECD undertake the task of developing agreed indicators to measure progress across all three dimensions of sustainable development. This included indicators that can measure the decoupling of economic growth from environmental degradation. The report from this process noted that "the decoupling concept cannot easily be applied to the fisheries sector and the lack of pertinent data makes it difficult to present a wholly adequate decoupling indicator for the fishery sector" (OECD 2002, p. 56). The reason for this is that population growth, per capita income and changing consumer preferences are underlying factors driving the demand for fish products. At the same time, however, sound fishery management requires that settings for maximum sustainable yields be followed. In principle, these are set independent of the level of economic activity, thereby making the decoupling concept difficult to apply in this case.

Territorial indicators

The Territorial Development Policy Committee's Working Party on Territorial Indicators has proposed a set of core indicators for assessing the socio-economic performance and impact of territorial policies. These indicators are intended to provide, firstly, a coherent set of economic, social and environmental criteria as a basis for comparing any region of an OECD member country with any other such region and, secondly, to evaluate territorial disparities in member countries based on this set of multidimensional criteria. The paper *Core Indicators: Proposed List and Theoretical Framework* discusses possible territorial indicators in addition to those already analysed in *Territorial Outlook* (per capita GDP, unemployment rate, employment and population.

2. Survey of OECD country experiences

In undertaking this study, OECD countries provided a series of case studies, which served to illustrate the development and implementation of social and economic indicators in their fisheries sectors. These case studies were supplemented with information obtained by the OECD Secretariat. The full case studies can be obtained from the OECD Fisheries web site: (*www.oecd.org/agr/fish*).

Australia

National reporting framework

Australian fisheries management agencies in 1999 embarked on a project to develop a national reporting system to demonstrate how well Australian fisheries (wild capture and aquaculture) are meeting the objectives of ecologically sustainable development. The intention of this project is to initiate a regular reporting process that will continue as an integral part of fisheries management. The Australian country brief provides an overview of the project, as developed by the Bureau of Rural Science (BRS), and its approach to developing indicators for all three dimensions of sustainable development: economic, social and environmental.

Policy issues

The main question being asked is "How does an entity (in this case a fishery) contribute to sustainable development?". The BRS framework initially divides the contributions of a fishery into two components: direct contributions to human well being, including economic and social, and contributions to ecological well being (which indirectly contribute to human well being). It further breaks down the contributions of a fishery into successively more specific sub-components until a level of detail is reached where the specification of an operational objective and an associated indicator for each component is possible. The selection of an indicator to measure performance with respect to that objective then follows. The objective, rather than the indicator, is the initial focus of discussion.

Concepts and framework

The National Reporting Framework (NRF), and the BRS Framework, from which it is derived, provides a process for developing sustainability indicators rather than specifying a particular set of indicators. The reporting unit is a fishery, as defined by the management agency. This allows reporting to be linked directly to management actions.

Data availability

Eight case studies were initiated in 2000 to apply the framework to various fishing methods and jurisdictions. A final report on the case studies will be completed at the end of 2001. Commercial, recreational and aquaculture operations were included and a case study of an indigenous fishery is planned. Each case study began with a two-day workshop at which stakeholders developed the set of component trees and started to identify operational objectives and associated indicators and performance measures. At the higher levels, the trees tend to be similar for all fisheries, whereas at the lower levels they diverge considerably in response to the different types of fisheries and the social, economic and biophysical environments in which they operate. Management responses currently in place, and actions to be taken if performance falls outside stated bounds, are also being documented. Over the next few months, the fisheries reports will be completed to serve as a model for other fisheries.

Proposed indicators

Major components of the NRF Framework include national social and economic well being. These components are then further sub-divided into more specific sub-components as required for the fishery. The component tree for contribution to human well being will reflect the characteristics of the communities related to the fishery. The component trees are developed through an open consultative process involving all stakeholders. The visual nature of the component trees has proved very effective in promoting and structuring discussion. More controversial questions such as how the contribution might be measured (using indicators) and whether the contribution is positive or negative, acceptable or unacceptable (performance measures) are postponed until later.

Economic indicators for Commonwealth fisheries

In a parallel development, a methodology for assessing the economic performance of Commonwealth fisheries[1] has been developed by the Australian Bureau of Agricultural and Resource Economics (ABARE). The methodology is detailed in Rose, Stubbs, Gooday, Cox and Shafron (2000) and applied to a selection of major fisheries in ABARE (2001).

Policy issues

The methodology has been developed to assist in providing an assessment of the performance of fisheries management against the legislated objective to pursue maximum economic efficiency in the management of Commonwealth fisheries. This requirement exists alongside other objectives relating to efficient and cost effective management, the pursuit of ecologically sustainable development and accountability to the industry and the broader community. The emphasis in the approach is therefore on the evaluation of management outcomes and providing guidance for the timing and direction of changes fisheries policy and management at the fishery level.

Concepts and framework

The key concept used in the methodology is that of resource rent. Due to well-identified measurement concerns, this is approximated by a measure of the apparent net returns to the fisheries resource (equal to revenue from fishing less the social opportunity cost of capital and other inputs used in fishing (including management inputs). The estimates of net returns need to be interpreted in conjunction with assessments of

changes in both the manufactured capital stock (that is, the fleet) and the natural capital stock of the fishery. In this way, the economic and biological health of individual fisheries and the performance of management policies can be assessed in an integrated fashion.

Data availability

To produce reasonably accurate estimates of net returns and the value of fishing capital for a fishery requires quite detailed financial, input and output information for the fishery. Generally the most cost-effective way to obtain such information is through a survey of a representative sample of operators in the fishery. Surveys of major Commonwealth fisheries are carried out annually on a rotational basis with each fishery being surveyed at least every second year.

Proposed indicators

The indicator of net returns to the fishery needs to be considered in the context of market conditions and the condition of the fishery. In the absence of a full bioeconomic model of the fishery, quantitative or qualitative information on a number of aspects of the fishery may shed light on its relative efficiency. Of particular importance are the condition of the fish stock, capital capacity, prices of the fishery's products and inputs and management structure of the fishery.

Denmark

In March 2001 the government of Denmark invited all interested parties to take part in a broad dialogue on the national strategy for sustainable development. The strategy documents include the Discussion Paper on a *Set of Indicators for Denmark's Strategy for Sustainable Development* (available at *www.mst.dk*). Public consultations on the strategy have been taking place until May 2002. Viewpoints aired in the debate will be used to select the final set of indicators for Denmark's Sustainable Development Strategy. The indicators will be used to continuously monitor and report on the progress made in implementing the strategy and achieving the objectives. The public consultation process is recognition of the view that sustainable development cannot be obtained without the participation of local authorities and citizens, since they are perceived as having the most detailed knowledge about local aspects of environmental issues and thus play an important role in securing sustainable development. Table II.3 provides some preliminary objectives and indicators for fisheries in Denmark.

Table II.3. **Objectives and indicators for fisheries in Denmark**

Objectives and activities	Indicators
The marine fish stocks and ecosystem should be preserved	1. Spawning biomass and fish mortality compared to fishing quotas, size of catch and biologically safe standards
The volume of discarded catch must be reduced	2. Volume of by-catch and discarded catch broken down on fishing gear and fisheries types (based on estimates)
Fishing gear must be made more selective, so that unintended by-catch (including harbour porpoise) and unintended impacts on the sea bed can be avoided	3. By-catch of harbour porpoise (estimates) and monitoring of effect of special preventative measures (*e.g.* electronic preventative measures)
Size and composition of fleet should better reflect fishing possibilities	4. Fisheries fleet capacity (tonnage, engine power, etc.) and composition

Source: Set of Indicators for Denmark's Strategy for Sustainable Development (available at *www.mst.dk*).

Importantly, Danish activities to develop indicators should constantly refer to international deliberations on selecting and developing indicators for sustainable development, particularly with respect to discussions on this issue taking place in the EU and ICES.

Italy

In 2000, Italy began a process of rationalisation and harmonisation of the existing surveys of the fishery sector. The purpose in this process was to address concerns about the availability and use of disparate statistical sources for the sector. The review resulted in the definition of a sample survey on fish catches and their relative values and costs. One of the objectives in the new process is to satisfy the EU legislative requirements and, more generally, to meet national and international information needs. It is particularly noteworthy that the programme on systematic monitoring of fishery indicators in Italy is targeted towards an evaluation of economic and management features of fisheries – it does not aim to estimate and assess biological resources.

The methodology of the survey has been developed by Instituto Ricerche Economiche Pesca e Acquacoltura (IREPA Onlus), in collaboration with the National Institute of Statistics (ISTAT).[2] ISTAT and IREPA also provide other fisheries statistics in support of the survey. In the future the Ministry for Agricultural and Forestry Policy will be responsible for the surveys and for the publication of statistics.

Policy issues

The aim of the statistical survey is to gather information for evaluation of economic and management performance of the fisheries. This includes evaluation of:

- fishing effort and activity;
- landings and prices by group of species; and
- economic and social performance.

Concepts and framework

The survey is based on a stratified sampling method with more than 750 vessels monitored each week. Data collection is very complex due to the high number of species caught, the length of the coastline (8 000 km) and the vast number (800) of landing points.

The National Fleet Register contains basic vessel data on all Italian fishing vessels. The Fleet Register is held at the General Directorate for Fisheries and Aquaculture of the Ministry of Agricultural and Forestry Policies (Direzione Generale Pesca del Ministero delle Politiche Agricole e Forestali). Data on high sea and tuna fishing vessels are collected by other methods.

Data availability

Data are collected by use of three specific questionnaires:

1. an annual questionnaire to record technical, dimensional and vessel – management information on the sample units and relevant socio-economic aspects (number of shipowners, their ages, their property quotas and relationships between them);
2. a quarterly questionnaire to record data on fixed and variable costs, and on social aspects of property and crew;

3. a weekly questionnaire to record information reporting activity such as fishing time and area, average number of crewmembers, gears used, quantities, prices and revenues – as per species or group of species – and trade channel for sales.

Proposed indicators

Based on the sample survey results, a range of economic and social sustainability indicators for Italian fisheries are being developed. These indicators are primarily related to catches, costs and earnings at a highly disaggregated level in terms of regions, gear types and species. One of the key advantages in such a cross-sectional approach to viewing the data is that it allows a more complete interpretation of the impact of management changes on fishers' behaviour and returns, particularly in fisheries characterised by multi-species and multi-purpose fleets.

The key data collected relate to: fishing effort (measured in terms of fishing days per year); catches; earnings; and prices. From this data a wide range of indicators can be developed. These include:

- catches, earnings, costs, value added and gross profit per unit of capacity;
- catches, earnings, costs, value added and gross profit per fisher;
- capital, costs and gross earnings per ton of catch; and
- capital per unit of earnings and gross profit.

Analysis of these indicators, in conjunction with data on the biological state of the fish resources, can provide valuable guidance to fisheries managers in deciding on the future settings for key parameters of the management system. A case study of the approach as applied to the fishing sector in Sicily is available on the OECD Fisheries website and is summarised in Box II.2.

Japan

People in fishing communities often depend heavily upon the given natural resource. Biological sustainability and the socio-economic and cultural sustainability are closely connected. The Japanese case study, *Socio-economic Criteria for Monitoring Sustainable Fisheries Management and Development in Japan*, gives a brief overview of socio-cultural aspects of fisheries and explores criteria for guiding and monitoring the development of small-scale fishing communities. These fishing communities are examples of a distinctive form of local adaptation in remote areas. Such adaptive ways of life have evolved over generations and could be considered cultural assets.

Policy issues

Socio-cultural aspects of fisheries need to be understood and incorporated into sustainable fisheries management and development. Fish harvesting, dealing, processing, marketing, and retailing make up a major part of the basic economic activities of fishing communities. For example, in the town of Ikituki in the Ikituski Islands, Nagasaki prefecture fisheries' workers and their families make up 25% of the town's population and fisheries is the basis for a large part of the regional economy. Fluctuations in the fish production have a direct impact on the regional economy as well as on social activities and cultural life.

Fisheries management failure does not only negatively affect the fishing industry, but also the fishing communities at large. In some cases out-migration and the death of

Box II.2. **Economic and social sustainability indicators for the Sicilian fishing sector**

Marine compartments in Sicily represent the most important productive area of the Italian fishery sector. This is due both to the high number of people employed and fishing companies present along the 1500 km of the region's coastline and to the high levels of production. However, the biomass of a number of fishing stocks is below equilibrium levels, resulting in a potentially critical economic situation for stakeholders. The wide range of fishing traditions and ecological conditions of different fishing areas require the implementation of a range of management measures. In the Mediterranean fishery, most of the fishing gears target different species (apart from tuna, swordfish, clam and red shrimps) and therefore management actions on a species specific basis can generally be carried out.

Small vessels represent the most important segment of the fleet in Sicily, totalling 2 982 vessels in 2000 (equal to 8 524 GRT and to 63 235 kw). In addition, there are 611 bottom trawlers as well as 200 multipurpose vessels that have other licences in addition to bottom trawling. There are also 447 multipurpose vessels that possess more than two fishing licences (excluding the bottom trawling licence) and 89 pelagic seiners.

The regional administration analysed the major economic and social characteristics of the two greatest segments of Sicily's fleet (small-scale fishery and bottom trawler) in order to assess the major problems and weaknesses of the sector. The analysis was conducted for the period 1998 to 2000.

It was found that the structure of the small-scale fishery has led to poor economic management of the production units resulting in high costs per unit of product and unsatisfactory yields. Often, especially for small vessels, yields provide enough to sustain the vessel owner and his family, but leaving nothing to re-invest. The small-scale segment is also characterised by a high degree of obsolescence – the mean age of vessels is greater than 27 years. The combination of declining catches and declining revenue, coupled with constant effort has contributed to the poor economic position of the sector (see table). The composition of species caught has also changed with a shift towards lower value small pelagics.

Key economic indicators in selected segments of the Sicilian fleet

Percentage change 1998-2000

Indicator	Small-scale segment	Bottom trawl segment
Catches	–10.3	–10.1
Prices	4.8	18.5
Earnings	–6.1	6.5
Costs	4.4	n.a.
Labour costs	–0.3	n.a.
Gross value added	–9.2	n.a.
Gross profit	–14.4	6.5

n.a. Not applicable.

Source: OECD.

The situation in the bottom trawl segment of the fleet is less critical, but still raises concerns about overfishing. Production has decreased at the same time that effort (measured in days of fishing) has increased (see table). Prices have increased strongly and, as a consequence, earnings and profits have also increased.

Box II.2. **Economic and social sustainability indicators for the Sicilian fishing sector** *(cont.)*

The conclusion from the study was that the intensity of catches has compromised the economic sustainability of the fleet. This is particularly the case for the small-scale sector where the most appropriate measure identified (at least for the short term) was to control fishing days in order to allow fishing stocks to recover and to restore economic conditions adequate to the amount of capital invested and to companies' profit. It was advocated that fisheries managers allow fishers to directly manage small fishing areas with homogeneous fishing gear types. The study also called for the introduction of total allowable fishing days allocated directly to vessels.

Source: Italy case study (available at *www.oecd.org/agr/fish* under "Documentation" section).

communities could be the ultimate result of such failures. Thus, there is an urgent need to examine all human aspects of fisheries, in particular the socio-economic and cultural ones.

Concepts and framework

There are two major reasons why socio-economic aspects of fisheries so far have not been successfully incorporated into current management and development regimes. First, socio-cultural aspects of fisheries are not well understood or appreciated. Second, culture is generally complex and difficult to characterise and there is no standardised method for designing culturally relevant indicators. Culture actually play a critical role in social patterns of resource use, food access and food production. To facilitate such an understanding, the paper introduces a concept of "natural resource community" that is defined as "a population of individuals living within a bounded area whose primary cultural existence is based on the utilisation of renewable natural resources".

Small-scale fisheries are an example of such a society that has distinctive cultural characteristics, such as access to fishing rights, information control, various fishing methods, marketing strategies, and egalitarian principles among crews, kin-based crew recruitment and mutual assistance. For the people involved, fishing is a way of life that for generations has been passed down from father to son within a family business framework. People's identity is based on their participation in the production process. In other words, loss of fishing opportunities means loss of identity, social ties, and, at the extreme, loss of communities. Characteristics of small-scale fisheries has been described as the "complex cultural systems that have evolved from long standing and complex interplay of local resources, physical environments, social organisation, value systems, and information".

In relation to the social pillar of the sustainable development paradigm, the study notes that it is necessary to ensure "self-sustaining improvements in productivity and quality of communities and societies including access to basic needs such as education, health, nutrition, shelter and sanitation; as well as employment and self-sufficiency". Following this definition, a fisheries development plan should be based, at least in part, on the basic needs of people at the community level.

Fishers very often have profound knowledge of local resources, called Traditional Ecological Knowledge (TEK), and their own perception of sustainability. The value of TEK was discussed at the 1992 Earth Summit, and has been applied to a number of projects,

incorporating TEK and the local population into new management and development regimes.

Data availability

It is likely that data will have to be collected on a case by case basis, but this is not discussed in any detail in the case study.

Proposed indicators

To make fisheries more sustainable, it has been agreed that socio-cultural aspects of fisheries need to be incorporated into current management and development regimes. The issue is how this is to be done. Japan's case study explores socio-economic criteria and suggests two areas of concern: 1) the basic needs of people and their quality of lives; 2) the incorporation of local people's perception of sustainability. In this context, fisheries development should be considered as community based socio-economic development.

Korea

Policy issues

Korea has embarked upon a process of exploring the development and use of sustainability indicators to assist in the integrated management of fisheries. The process seeks to identify meaningful sustainability indicators that can be agreed upon covering all the dimensions of sustainability (such as ecological, socio-economic, community, and institutional sustainability). The impetus for this work arises largely from the recent introduction of TACs in selected fisheries. Since 1999, five species (the common mackerel, sardine, horse mackerel, Spanish mackerel and queen crab) have been selected as sampled species for TAC determination and have been investigated in order to assess their stocks using the allowable biological catch (ABC) by the National Fisheries Research and Development Institute. Limited entry in the form of licence permission systems has historically been the main fishery management tool in Korea.

Concepts and framework

The framework for the sustainability indicators being considered as part of this process revolves around the use of bioeconomic models. The development of a bio-economic model is a multidisciplinary task, combining biological components of catch and effort with economic components, revenues and costs. From the bioeconomic models, indicator estimates based on sustainable yield concepts, including maximum sustainable yield (MSY), maximum economic yield (MEY), open access equilibrium (OAE) and dynamic MEY, can be derived. In the pilot study, six specific species are considered (anchovy, squid, horse mackerel, sardine, common mackerel and Spanish mackerel). The indicators are therefore model based estimates of *ex ante* values for key parameters in the fisheries. They therefore can provide a benchmark against which to evaluate the impacts of various management options within the model after their implementation in the fishery.

Data availability

Firstly, very few indicators are compiled in the field of fisheries. In spite of much statistics compiled, there has been very little effort to generate economic and social indicators. Secondly, biological and ecological data and statistics are in a poor condition. In particular for ecological data such as the effects of gear on habitats, biodiversity, data on

fishing pressure in the fished area is not produced and seems not likely to be produced in a foreseeable future. Thirdly, a problem lies in the designation of statistical agency. The Ministry of Maritime Affairs and Fisheries (MOMAF) and other fisheries institutions play very limited roles in producing approved (official) statistics. The concept of sustainable development is deeply involved in the biological and ecological characteristic of fisheries and so it will need more specific expertise. Therefore, most of the ecological data and information will need to be generated by fisheries-oriented institutions. Fourthly, they are *ex post* rather than *ex ante*, measures of what has happened rather than what will happen. Finally, the indicators that are available are not likely to be the indicative of fisheries sustainability.

Proposed indicators

As noted above, it is proposed that the range of biological and bioeconomic indicators (including MSY, MEY, OAE, and dynamic MEY) derived from the modelling process be used to assess the appropriateness of management policy settings, particularly with respect to TACs. The likely impacts of changing policy settings, institutional structure, fleet characteristics, and so on can then be assessed in either an *ex ante* or an *ex post* manner.

Spain

Spain has been undertaking a project developing economic indicators that can be used to help control fishery activity and applying them to Mediterranean fisheries. The country paper includes a general discussion of the use of indicators, the relationship between economic and environmental indicators and the requirements to be fulfilled for indicators to be useful management instruments. This project has been conducted under the responsibility of the Socio-economic Subcommittee of Scientific Advisor Committee of General Committee of Mediterranean Fisheries by Spanish and Moroccan researchers.

Policy issues

For the improvement of the socio-economic conditions of the fishing industry there is a need for information on the socio-economic impacts of changes in the resources (stocks) and the development of fishing effort across countries, areas, gear types and fisheries – effort being understood as capital/investment and labour/employment measures. Alternative policies for the transition from unsustainable to sustainable fisheries should be assessed with regard to profit (revenues and costs) and employment implications.

Concepts and framework

A previous study was presented to the Working Party on Fisheries Economics and Statistics (WPFES) of the General Fisheries Commission for the Mediterranean (GFCM) in 1998. As a result of this WP activity an advisory group composed of experts from national administrations was set up. This advisory group has contributed to further development of indicators for the Mediterranean Sea fisheries.

The economic indicators should complement the tools used in biological assessment of resources, to clarify the consequences for society of resource degradation. The decision-maker's regulations (on fishing schedules, licenses, taxes, etc.) are usually aimed at specific fleet groups. Therefore, a proper fleet segmentation is essential in the construction of indicators. For this reason the concept of "Operating Unit" has been developed. In the

Mediterranean Sea context, an important issue was to reach agreement on the number of segments that should be established.

Data availability

Several methodological and data difficulties have arisen during this project. In particular, capital and production costs were difficult to handle, from both a methodological and a practical point of view. This report gives an overview of data sources and the algorithms for the indicators; *i.e.* describes how basic data are being used to calculate the value of each indicator.

To demonstrate the usefulness of indicators to fisheries management a pilot study was developed for the Western Mediterranean Alboran Sea fisheries. This sea is one of the most productive areas of the Mediterranean, and is jointly exploited by Spain and Morocco (see Box II.3).

Indicators

There are two main types of indicators, **national indicators** that give general information about the country and its fishing industry, and, **local operating unit indicators** that give area and vessel group specific information. The former includes indicators for landings – quantity and value, per capita consumption of fish, trade balance, employment, fisheries contribution to GDP and aquaculture production, and the latter includes indicators for physical productivity and capacity, effort, fish prices, fixed and operational costs and profit. The 15 indicators make it possible to compare economic and social conditions across fisheries and areas in Spain and Morocco.

United States

Policy issues

In the United States, Federal marine fisheries legislation mandates the consideration of the importance of fishery resources to fishing communities in order to provide for the sustained participation of such communities, and to the extent practicable, minimise adverse economic impacts on such communities. Thus, the magnitude of both community engagement in, and dependence on, fisheries are important policy issues.

Concepts and framework

A fishing community is one which is substantially dependent on or substantially engaged in the commercial, recreational or subsistence harvesting or processing of fishery resources to meet social and economic needs. This includes fishing vessel owners, operators and crew and United States fish processors that are based in such a community. For a fishing community, the diversity of species and catch methods available for harvest and use is an important component of sustainability and of community social and economic stability.

Data availability

Information used to identify communities involved with fisheries differs between commercial, recreational and subsistence fisheries. While unified and uniform data sets would be the optimal choice for managers of these fisheries, historical practice and policy decisions have left the National Marine Fisheries Service (NMFS) with a patchwork of data sets. In the commercial fisheries, Federal and state fishing permits, fish-processing permits, vessel registrations, and landings data can be combined to identify communities in which landings occur and harvests are processed. Importantly, the homeports of vessels

Box II.3. **Economic indicators in the Alboran Sea: results of a pilot study**

The Sea of Alboran is one of the most productive fishing areas of the Western Mediterranean. Two countries share the exploitation of these highly productive waters: Spain and Morocco. Although the Spanish and the Moroccan coastlines enjoy an unequal degree of development, the long fishing tradition, tourist development and unemployment exert a high pressure on the environment on both coastlines.

The northern coast suffers from pollution caused by tourists. Tourist areas are densely populated and their inhabitants have a liking for larvae (called whitebait), which exerts pressure on resource stock despite regulations forbidding the catch and sale of larvae. The southern coast faces quite a different problem in that fishing is virtually the only source of employment. Nevertheless, both areas face similar management challenges (although in different degrees of intensity) in dealing with a strong pressure on and competition for resources. Excessive fishing effort has reduced sardine and anchovy catches in recent years.

Data for each of the 15 indicators was collected for 1998 across 9 vessel groups and 16 geographical areas Analysis of the national indicators for both countries reveals quite different structures of fishing activity even though they are based on a similar resource. The socio-economic differences between the countries help explain the diversified position on fishing that each country carries into its management regimes. The key findings from the pilot study are summarised below.

Physical production indicators

In terms of the average production of vessels in each port, it was clear that bigger vessels obtained a higher level of productivity. It was also found that productivity is higher in the ports located in the eastern area of the Alboran Sea.

Economic productivity indicators

With respect to the value of production per local operating unit, it was found that differences between ports were more significant than the differences between countries. This was also the case with the value of production per unit of capacity (in terms of GRT). However, when value is considered in terms of power of vessels (that is, horsepower per vessel), there is a considerably higher productivity in the Spanish fleet, particularly among small trawlers, longliners and dredgers.

Employment indicators

The outcome of Man Productivity (MP), expressed as the average value at first sale per employed fisher (in USD), are generally far better for Spain. Undoubtedly, this is due to the lower number of employees per vessel in the Spanish purse seiners and trawlers. Salary costs are significantly higher in Spain, although part-time activities attract very low wages. In Morocco, the lowest salaries are paid in ports found in areas with insufficient road communication and in the artisanal fisheries.

Capital and profit-related indicators

Of most concern, however, is the finding that profits are negative for most segments of the fleet in both countries. Gross estimated profit (GEP) varies across ports and between fleet segments within ports. While GEP is higher in the Spanish ports, many of the segments have GEP close to zero. In terms of net estimated profit (NEP) almost all segments, both in Spain and in Morocco, have negative NEP.

Box II.3. **Economic indicators in the Alboran Sea: results of a pilot study** *(cont.)*

The pilot study case for the Alboran Sea provided detailed indicators on the economic, social and capital structure of the fisheries in the two countries. It has also allowed assessment of the difficulties suffered by each segment. The tentative conclusion from the pilot study was that there are fewer differences between the costs and investment structures than expected. However, the negative earning performance of the respective fleets highlights concerns over the capacity and effort of the fleets to ensure sustainable livelihoods for the respective societies. By undertaking the analysis at a very high level of disaggregation in terms of fleets segments and ports, decision-makers have objective data to assess the impact of decisions on different sectors of the industry in both countries.

Source: Spain case study (available at *www.oecd.org/agr/fish* under "Documentation" section).

must also be identified since many vessels land in other ports during the course of their fishing year. Federal and state data on commercial vessel crews and operators are based on information gleaned from vessel permits and logbooks. Similarly information on processing plant employment relies on self-reporting by plant owners and operators.

The Marine Recreational Fisheries Statistics Survey (MRFSS) consists of an intercept survey of fishermen at dockside and fishing sites and a telephone survey of coastal county households. The intercept survey collects data on species composition, catch rates, fish lengths and weights, and some economic and demographic data.

Since the data sets described above have been developed for purposes other than assessing the sustainability of fishing communities, verification of estimates through ethnographic and economic fieldwork is considered both important and necessary. NMFS and regional fishery management councils have commissioned ethnographic studies of fisheries to assist management decision-making for particular fisheries during the past twenty years, but comprehensive national or regional data bases have yet to be developed – other than in Alaska.

Proposal for indicators

The USA has proposed a considerable number of indicators at the community level, including on labour market, personal income, community isolation, public investment in physical and cultural infrastructure, community housing, demographics and families (in addition to Fisheries data on harvest, processing, and private and public community services).

3. Survey of social and economic indicators developed in other international organisations

FAO

The Food and Agriculture Organization of the United Nations (FAO) has developed a set of technical guidelines on the development of sustainable development indicators for marine capture fisheries (FAO, 1999). These guidelines provide general information about principles and practical approaches for the development and use of indicators in fisheries. In particular, they describe how to develop and implement a sustainable development reference system (SDRS) as a coherent approach to selecting indicators, reference points and the framework within which to use them, as well as techniques for visualisation, communication and reporting. It is intended that the guidelines be used by governments in

developing indicators that can track the progress of their fisheries towards sustainable development and the performance of their management schemes and fisheries policies against stated objectives. They can also be used to facilitate reporting at an international level and in regional fisheries bodies.

The SDRS is the basic framework presented in the guidelines and is used as a method to set objectives and organize the related indicators and their respective reference points. While a specific SDRS is not recommended, a number of options are described, with the use of a particular SDRS being dependent on the size and complexity of the fishery system to which it is to be applied. The choice of framework may also reflect policy priorities in particular fisheries and countries.

The guidelines also present a number of broad suggestions for criteria against which social and economic indicators could be developed and used in an SDRS. These criteria are presented in Table II.4, which also includes several criteria relating to governance. Table II.4 also presents some broad types of indicators that can be used in evaluating objectives that may be set under each criteria. Not all of these indicators will apply in a particular jurisdiction or circumstance and others may be needed depending on the particular objectives set for each scale, which will reflect regional, national and fishery priorities and policies.

As a follow-up to its indicators work, the FAO has been undertaking a pilot case study for the Penang (Malaysia) coastal fisheries. The objectives in the case study are to develop a SDRS for this set of fisheries and to test the relevance, comprehensiveness and practicability of the FAO guidelines on indicators. The FAO has, in co-operation with member countries,

Table II.4. **Examples of economic and social criteria and potential indicators**

Criteria	Example of indicator	Structure	Reference point
Harvest	• Landing • By-catch	• By species; age groups • By area • By fishery sub-sector	• MSY • Historical level • Policy target level
Harvest capacity	• GT (decked vessels) • No of boats (undecked ves.) • Total effort (see below)	• By fleet type • By fishery segment • Age composition of vessels • Fishing mortality/species	• Capacity or effort of MSY • Policy target level
Harvest value (in constant prices)	• Total deflated value (landed price)	• By species groups • By sub-sector and fishery	• Selected historical level
Subsidies	• Tax rebates • Grants	• By sub-sector • By fleets/fishery	• Historical level • Zero level • Target level
Contrib. to GDP	• Fisheries GDP/nat. GDP	• By species groups	• Historical level
Exports	• Export/harvest value	• By species groups • By fishery segment	• Historical level
Investments	• Market or replacement value • Depreciation • Fleet age composition	• By fleet type • By fishery	• Historical level
Employment	• Total employment	• Sub-sector • Fleet/fishery	• Historical level (?) • Realistic policy target
Net returns	• (Profit + rent) • Net return/investment • Value of entitlements	• By sub-sector • By fishery	• Historical level • MEY
Effort (mainly at fishery level)	• No of vessels; fishing time • Amount of gear used • Employment	• By fishery segment • In physical or monetary terms	

Source: FAO, 1999.

also conducted a pilot study on the Mediterranean Alboran sea fisheries activities examining in particular (fleet segmentation and socio-economic indicators (see section on Spain above). Based on the same methodology this pilot study is being followed by a study on the Gulf of Gabès (Tunisia) fisheries. It is also likely that similar work is going to be organized for the Adriatic Sea fisheries (through the ADRIAMED project).

The Regional Technical Consultation (RTC) on Indicators for Sustainable Fisheries Management in the ASEAN Region was held in Haiphong, Vietnam from 2 to 5 May 2001. This was at the invitation of the Ministry of Fisheries, Vietnam, the Food and Agriculture Organization of the United Nations (FAO), the Southeast Asian Fisheries Development Center (SEAFDEC) and the Assessment of Living Marine Resources in Vietnam (ALMRV).

The Consultation discussed the status of ASEAN region fisheries and their management with the aim of providing a basis for the identification of practical indicators for management of sustainable fisheries in the region. The Consultation identified potential applicable indicators taking into consideration the experiences from participating organisations. The outcome of the Consultation offers the basis for policy considerations on indicators for sustainable fisheries management and provides a basis for technical preparation for the ASEAN and SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: "Fish for the People", scheduled for 19 to 24 November 2001.

The Consultation identified a possible classification of indicators encompassing various disciplines for future consideration, including a number of economic and social indicators (Table II.5).

Table II.5. **Indicators proposed in the FAO Regional Technical Consultation**

Economic and social indicators	Possible analytical categories
1. Value of landings	(sector,[1] area, fleet, fishery)
2. Export (Q, V)	(sector, species)
3. Imports (Q, V)	(sector, species)
4. Per capita consumption	(sector, area)
5. Investment (number of new boats)	(sector, area, fleet, fishery)
6. Number of fishers	(sector, area, fleet)
7. Employment	(primary/secondary) (sector, area)
8. Profitability (*e.g.* operational margin)	(fleet, area)
9. Cost per trip	

1. Sector is defined for the fishing sector as a whole *e.g.* small scale, marine, inland and commercial fisheries, etc.

Source: FAO, 1999.

The Consultation concluded that the adoption of indicators for the sustainable development of fisheries is an on-going process, and that the Conclusion and Recommendations from this meeting should be used as a basis for further technical and policy preparation both for the ASEAN/SEAFDEC Millennium Conference and their own national activities.

ICES

Fisheries management in the the International Council for Exploration of the Seas (ICES) area has encountered a range of problems including collapses or near collapses of fish stocks, persistence of overcapacity in the fishing fleets and limited acceptance of the fisheries policies among both the fishers and the general public. Facing these problems

ICES has recognised the need to develop methods and approaches for evaluation (via indicators) of management regimes and alternative management strategies of fisheries systems.

Policy issues

In order to develop the scientific basis for sustainable use and protection of the marine environment including living marine resources there is a need for ICES to:

- evaluate the potential of new management regimes and strategies that are robust, cost effective, and sustainable; and
- develop and improve fisheries assessment tools that utilise environmental information, consider biological and socio-economic interactions, and address issues of uncertainty, risk, and sustainability.

Concepts and framework

In 1999 the Working Group on Fisheries Systems (WGFS) was established to respond to these tasks within the ICES strategy. However, since members of this working group mainly are from universities and independent research institutes, funding of this work has been more difficult than for the major ICES committees.

The terms of reference (TOR) for the WGFSs first year of operation included to:

- develop a framework and methodology for the analysis of fishery system performance; and
- test and refine this framework and methods using designated case studies;
- explore the applicability of frameworks such as the FAO "Sustainable Development Reference System".

The TOR for the second year of operation included to:

- review the progress in implementation of case studies (North Sea demersal fisheries and New England Scotian Shelf fisheries) and adapt work plan for these case studies;
- specify and refine methods to be used in case studies;
- develop criteria for performance evaluations of fisheries management based on literature reviews.

The WGFS reported to the Resource Management Committee at the 2000 and 2001 Annual Science Conferences (see ICES 2000, 2001).

The ICES strategy identifies the need to "Evaluate the potential of new management regimes and strategies that are robust, cost effective and sustainable". Thus, robustness, cost effectiveness and sustainability are the key criteria for performance evaluation. The WGFS define robust management regimes as those that are strong and resilient enough to handle a wide variety of situations and high degree of risk and uncertainty in biological, economic and social environments. They are able to learn from changing situations and surprises, resolve conflicts and adapt accordingly. Cost effectiveness relates to objectives being achieved in the lowest cost manner. Costs include Costs of management, Information Costs, Decision-Making Costs, Operational Costs and Monitoring, Control and Enforcement (MCE) Costs. Operational costs are the costs to the fishing industries caused by management. Sustainability is understood to include ecological, social and economical sustainability of the management system.

Performance evaluation framework

The performance of fisheries management systems is evaluated within a framework that is an expanded version of the International Whaling Commission (IWC) framework for management evaluation. This comprises the processes in and interactions between four subsystems: the knowledge production system, which produces the cognitive basis for management, the management decision system which includes the policy making and measures decisions, the implementation system and the adaptation system which includes the adaptation of the fleet to management measures.

Data availability and indicators

The WGFS has been working on data collection and analysis of two major ICES fisheries and fisheries management systems, North Sea Cod and Georges Bank Cod.

Researchers participating in the WGFS have developed research proposals for these two fisheries and management systems. During the winter 2001-2002 intersessional work will be undertaken on performance criteria and preliminary performance evaluations will be produced on basis of available literature on these two cases.

4. Key issues emanating from the survey

The aforementioned survey of the developments and use of economic and social fisheries in OECD member countries and other international organisations has revealed that there are many directions for work. Many OECD member countries place a particularly high priority on the need for social and economic indicators and have devoted considerable resources to the development of this stream of information. However, few of these initiatives have reached the stage where economic and social indicators are produced and used on a regular basis – the evolution of such indicators for fisheries is still very much in its infancy. The survey has also highlighted a number of key issues that help to explain this and that need to be considered when developing an OECD-wide approach to the use of economic and social indicators for fisheries.

Diverse policy objectives of member countries

Table II.6 provides a summary of the key policy issues being addressed by member countries and international organisations in developing indicators for fisheries. It is clear that a number of OECD member countries consider the development of indicators to measure national progress towards sustainable development to be of a relatively high priority. However as seen in the review of national developments and in Table II.6, there is a significant degree of diversity across OECD countries regarding the key policy issues to which current efforts to develop sustainability indicators are being applied.

In a number of countries the policy priority is the assessment of regional impacts of fisheries policy changes, particularly with respect to the impact on local and regional communities. In the United States, this is being primarily driven by legislative imperative, while in Japan there is increasing concern about the impact of structural change on smaller communities that are dependent on fishing (a direct consequence of community based management systems). Other countries are focussed on the economic performance of their national fleets and of the various fisheries within their EEZs. Countries such as Spain, Australia, Korea and Italy are investing considerable effort in developing an improved understanding of the economic performance of their fishing sectors, primarily at the individual fishery level.

Table II.6. **Summary of policy issues addressed in the survey of current indicators work**

Entity	Policy issues						
	Market prices		Economic performance	Government financial transfers	Management costs	Social	Others
	Raw fish	International trade					
Australia			(F)			F	F
Denmark							F
Italy	F, N		F, N			F, N	F, N
Japan						R	R
Korea			F				
Spain	F (N)		F (N)			F (N)	F (N)
USA	R					R	R
OECD[1]		(N)		N		N[2]	
FAO	F	F	F			F	F
ICES			F		F		F

N: National level; R: Regional level; F: Fishery level.

1. See OECD (2001d).
2. Employment.
3. Includes proposals, case studies and established programmes.

Source: OECD Secretariat.

The diverse policy priorities result in a wide range of approaches to developing indicators being adopted within member countries. At the broader OECD level, such diversity makes inter-country comparisons based on existing national approaches problematic. Most of the indicators are being developed at the fishery level with a wide range of techniques: there is very little commonality. While this reflects the different policy imperatives in member countries, it may also be feasible to develop a broad set of national level indicators within which the range of national interests can be accommodated and into which the various national sets of priority indicators can feed. If it is deemed necessary to develop an OECD-wide set of indicators, this will need to be done at a relatively aggregate level, focussing on those economic and social policy issues that are common across countries. The indicators can then provide a basis for more detailed examination of key issues in individual countries. The methodologies, concepts and definitions used to elaborate indicators must be well identified in order to allow correct comparisons.

However, there would necessarily be a lack of a framework at the OECD level within which the indicators could be assessed. Reporting of trends in these variables on their own would take the form of information transmission rather than being targeted at any particular policy objective. For example, it is difficult to determine if an upward trend in employment for a particular country is a positive or negative contribution to sustainable development without an understanding of the underlying policy objectives and needs of the country. If the objective were to reduce effort in a fishery, then an upward trend in employment may be counterproductive to achieving sustainable development. For other areas, the objectives may be much clearer and unequivocal. For example, the objective in relation to government financial transfers (other than management costs) could be to reduce such transfers to zero over time in the interest of appropriate resource allocation and the economic well-being of fisheries.

Diverse approaches to indicator frameworks

The diverse policy objectives and priorities of OECD countries are reflected in the range of approaches being taken to the development of indicator frameworks. There is very little

commonality amongst the countries with respect to frameworks and the various approaches clearly reflect the policy processes and demands faced by the individual countries. It is noteworthy that none of the countries has pursued the PSR framework as a means of organising and analysing sustainable development indicators for fisheries. Instead, the countries have pursued quite distinct approaches depending on their policy needs.

Some countries (such as Australia) have developed measures of economic returns to their fisheries and have been able to employ them (to varying degrees) in assessing the economic performance of their fleets and the effectiveness of their fisheries management systems. These indicators are primarily an *ex post* evaluation of performance and represent an attempt to identify emerging pressures on both the fishing sector and the management systems. Australia has also been developing a National Reporting Framework that provides a process and procedure for developing sustainability indicators rather than specifying and enforcing a particular set of indicators over the wide range of fisheries situations.

Other countries (such as Spain, Italy and Korea) are embarking on ambitious programs of developing objectives and targets for fisheries management based on the use of bioeconomic models. Such an approach differs from the former in that it aims to set targets and then measure progress towards those targets.

The advantage of the second approach is that it allows the establishment of target or threshold values for key variables against which progress can be assessed through the use of indicators. Without such targets, the value of indicators can be diminished in that it may not be necessarily obvious as to what the indicators are being measured against. That is, in an *ex post* approach to the evaluation of fisheries performance, it may not always be feasible to clearly (or quantitatively) define the benchmarks or reference points against which progress should be measured – the emphasis is more on providing guidance to potential improvements in management. However, the use of bioeconomic modelling to establish such targets can be very resource intensive and the use of such modelling itself has a number of advantages and disadvantages that would need to be taken into account when applying the modelling results to policy development.

Data availability

Based on the country survey there appears to be a significant difference across countries with respect to both the available data and the institutional capacity to provide relevant data to support the development of sustainability indicators. However, there are benefits and costs that need to be considered when developing indicators. Obtaining data for use in indicators is not costless and there needs to be careful consideration as to whether or not there are net benefits associated with the use of the indicators for which the data are collected. Policy makers will need to ensure that the resources that are employed in developing, implementing and interpreting a given set of indicators are outweighed by the benefits that may accrue from improved decision making in fishery policy and management. However such a trade off is often not explicitly considered before developing indicators.

National versus regional indicators

Fisheries systems differ across countries with respect to the characteristics of fisheries and management systems and the social and cultural environment within which fisheries sectors operate. The range of national situations reviewed in this survey highlights the fact that the use of micro-indicators at the fishery and community/regional level within a national context has been the preferred national approach to date. Clearly a uniform

international approach to indicators at the macro or national level for the purpose of undertaking cross-country comparisons would be very difficult to achieve. As a result, there is little common ground across countries at the level of micro-indicators that can sensibly used for the purpose of international comparisons.

Notes

1. Refers to those fisheries under the jurisdiction of the Commonwealth government and excludes fisheries under State government jurisdiction.
2. The programme is partially funded by the FIFG programme under the technical assistance measure.

Bibliography

Australian Bureau of Statistics (1999), *Fish Account, Australia*, ABS Publication 4607.0, Canberra.

ABARE (2001), Australian Fisheries Surveys Report 2000: Economic Performance of Selected Fisheries in 1997-98 and 1998-99, Canberra.

Caddy, J.F. and R. Mahon (1995), *Reference Points for Fisheries Management*, FAO Fisheries Technical Paper No. 347, Rome.

Chesson, J. and H. Clayton (1998), A Framework for Assessing Fisheries With Respect to Ecologically Sustainable Development, Bureau of Rural Sciences, Canberra.

FAO (1999), *Indicators for Sustainable Development of Marine Capture Fisheries*, Technical Guidelines for Responsible Fisheries No. 8, Rome.

Hilborn, R. and C.J. Walters (1992), *Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty*, Chapman and Hall, New York.

ICES (International Council for the Exploration of the Sea) (2000), Report of the Working Group on Fishery Systems (WGFS), 13-16 June, Copenhagen (ICESCM200/D:2).

ICES (International Council for the Exploration of the Sea) (2001), Report of the Working Group on Fishery Systems (WGFS), 12-15 June, Copenhagen (ICESCM2001/D:06).

OECD (1998), *Towards Sustainable Development: Environmental Indicators*, Paris.

OECD (1999), *Environmental Indicators for Agriculture: Concepts and Framework – Volume 1*, Paris.

OECD (2000a), *Transition to Responsible Fisheries: Economic and Policy Implications*, Paris.

OECD (2000b), *Towards Sustainable Development: Indicators to Measure Progress*, proceedings of Rome Conference, Paris.

OECD (2000c), *Modelling the Transition to Responsible Fisheries: Group I Case Studies*, Paris.

OECD (2000d), OECD proceedings, *Frameworks to Measure Sustainable Development: An OECD Expert Workshop*, Paris.

OECD (2001a), *Key Environmental Indicators,* Paris.

OECD (2001b), *OECD Environmental Indicators: Towards Sustainable Development 2001*, Paris.

OECD (2001c), *Sustainable Development: Critical Issues*, Paris.

OECD (2001d), *Review of Fisheries in OECD Countries – Country Statistics 1998/1999,* Paris.

OECD (2002), *Indicators to Measure the Decoupling of Environmental Pressure from Economic Growth*, Paris.

Pearce, D. (1999), "Measuring Sustainable Development: Implications for Agri-Environmental Indicators", in OECD, *Environmental Indicators for Agriculture – Volume 2: Issues and Design*, Paris.

Rose, R., M. Stubbs, P. Gooday, A. Cox and W. Shafron (2000), *Indicators of the Economic Performance of Australian Fisheries*, ABARE Report to the Fisheries Resources Research Fund, Canberra, October.

Smith, S.L. and C. Choury (2002), "Devising environment and sustainable development indicators for Canada", *Corporate Environmental Strategy*, Vol. 9, No. 2, pp. 1-6.

Table of Contents