UTILITY AND USES OF SOCIO-ECONOMIC INDICATORS ON THE ENVIRONMENTAL IMPACT OF FISHING ACTIVITES

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INDECO

DEVELOPMENT OF INDICATORS OF ENVIRONMENTAL PERFORMANCE OF THE COMMON FISHERIES POLICY

Project no. 513754

INDECO

Development of Indicators of Environmental Performance of the Common Fisheries Policy

UTILITY AND USES OF SOCIO-ECONOMIC INDICATORS ON THE ENVIRONMENTAL IMPACT OF FISHING ACTIVITES

CASE STUDY:

THE DANISH PELAGIC FISHERIES IN THE NORTH SEA

Specific Targeted Research Project of the Sixth Research Framework Programme of the EU on ‘Modernisation and sustainability of fisheries, including aquaculture-based production systems’, under 'Sustainable Management of Europe's Natural Resources'

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[FINAL]

The INDECO project

The purpose of this Co-ordination Action is to ensure a coherent approach to the development of indicators at EU level, in support of environmental integration within the CFP and in the context of international work on indicators. The principal objectives of INDECO are:

1. to identify quantitative indicators for the impact of fishing on the ecosystem state, functioning and dynamics, as well as indicators for socio-economic factors and for the effectiveness of different management measures;
2. to assess the applicability of such indicators; and
3. to develop operational models with a view to establishing the relationship between environmental conditions and fishing activities.

A consortium of 20 research organisations from 11 EU Member States is implementing INDECO. An Advisory User Group will provide a link between the researchers and policy makers, managers and stakeholders.

More information on INDECO can be found on the project's website: http://www.ieep.org.uk/research/INDECO/INDECO_home.htm

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1 INTRODUCTION

The first report generated under INDECO Work Package 6 (WP6, D8)[1] concluded that there are few socio-economic indicators used on a routine basis in fisheries management, specifically in relation to the social and institutional aspects.

The process of identifying socio-economic indicators has not followed the same path in biology and social sciences. This relates to the uses driving their development and the supporting research. Three phases in the process of establishing indicators can be distinguished: 1) reflection on a sustainable development framework, 2) analysis of mechanisms and processes impacting on sustainability with a disciplinary approach, and 3) analysis of mechanisms and processes impacting on sustainability with a multi-disciplinary approach.

Biology and other natural science research started to develop (very comprehensively) the phase 1 and are now developing the phase 2. Socio-economic research has focussed more on the phase 2, especially in relation to other research areas (e.g. ICZM and river basin management) whereas the phase 1, the sustainable development framework, hasn't been completed and still needs further consideration. In consequence phases 1 and 2 need to be further developed to progress toward the integration of natural and social sciences in phase 3. The INDECO project is intended to coordinate this type of integration.

This second Deliverable (D14a and b) under the WP6 presents two case studies to evaluate the utility and future possibilities for the use of socio-economic indicators in order to assess the CFP environmental performance. One case study (D14a) is the French Gulf of Lions trawl fishery in the Mediterranean Sea and the second case study (D14b) the Danish pelagic fisheries in the North Sea. The two case studies have been selected to provide insights into the availability of relevant socio-economic indicators and the utility of such information for fisheries management in two very different EU fisheries settings.

The methodological approach taken in the two cases studies are not identical but intended to be complementary. Both case studies deal exclusively with "state" indicators. The Danish pelagic fisheries case takes the international, European and national fishery policy objectives as the starting point and assess the availability of indicators on the achievements of/towards these objectives at the specific fisheries (metier) level, in this case the Danish pelagic fisheries . The Gulf of Lions trawl fishery case focuses on the adaptation of the Australian ESD framework to the European scene. The methodological positioning of the two case studies is illustrated in Figure 1.

[1] INDECO Project Deliverable No. 8: Review of the Usage of Socio-economic Indicators on the Environmental Impact of Fishing Activities, May 2005.

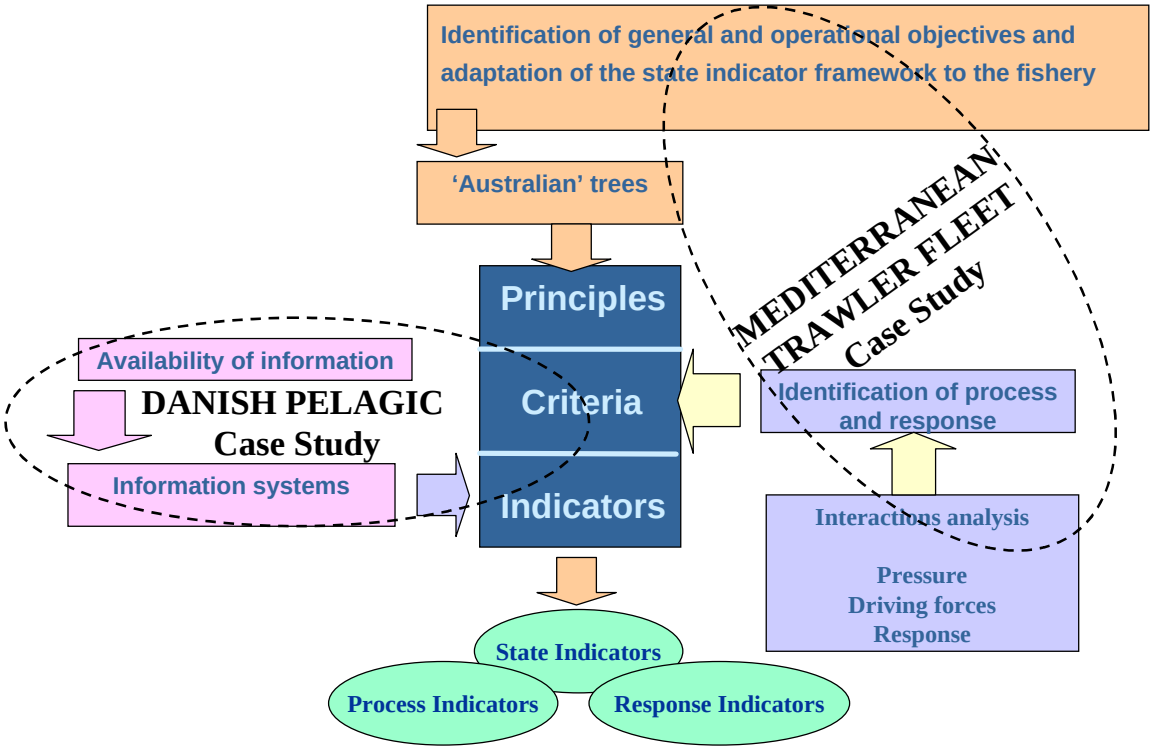

Figure 1 **Positioning of the case studies in relation to the methodological approach**

The third and final component (Deliverable 18) of the WP6 will draw upon the previous review (Deliverable D 8) and the present deliverable (D14a and b) to identify and analyse important gaps in the usage of socio-economic information for the study of fishing on ecosystems. The outcome of that analysis will be a series of recommendations to increase the utility of socio-economic information through appropriate and innovative methods and their applications. Particular attention will be given to the need to broaden the perspective on socio-economic analysis into the key domains of policy development and institutional change (with reference to fisheries management systems), and how this might be brought about by appropriate stakeholder participation and feedback.

2 THE DANISH PELAGIC FISHERIES IN THE NORTHE SEA

2.1 The Conceptual Framework

A framework developed by Rochet (Rochet et al., 2005[2]) for understanding the relation between state, indicators and management is presented in Figure 1. The framework was developed to represent ecological state and indicators, but has been applied to socio-economic states and indicators..

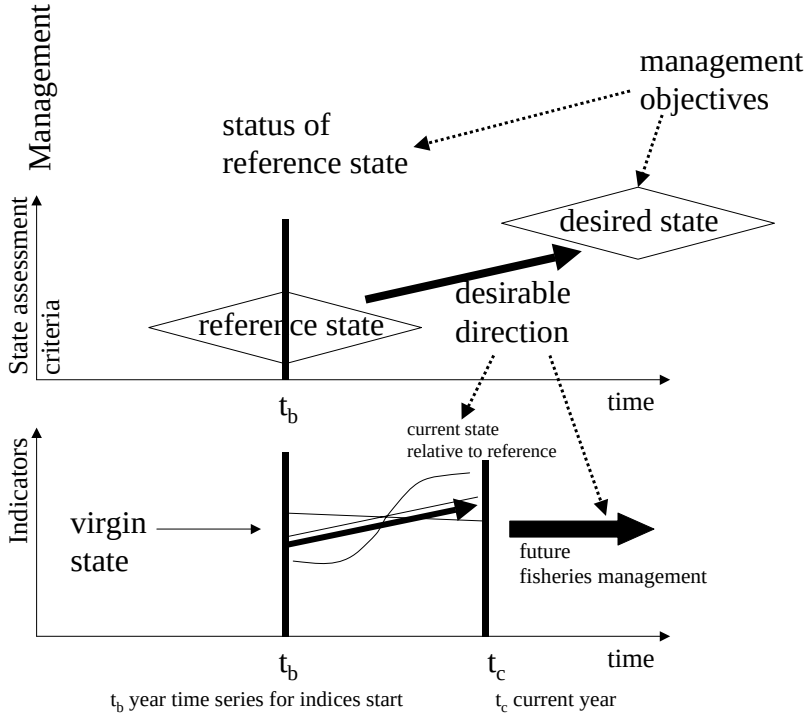

Figure 1 Framework for relating state, indicators and management of fish stocks (Rochet et al. 2005).

In the realm of ecology the framework components are:

1. *Management (policy) objectives*: statement of desirable and/or undesirable states of the ecological system. This could be determined by re-construction of virgin state, from an empirical assessment of some past state or area considered lightly impacted, or from stakeholders and managers views.
2. *Reference state*: the state of the ecological system at some past time t_b, *e.g.* the year time series of indicators starts. Compared to the desirable / undesirable states, this gives *status of reference state*, and defines *desirable* and *undesirable directions* for indicator trends.
3. *Trend assessment*: combining trends in indicators to determine whether the ecological system recently moved towards the desirable direction.
4. *Relationships* between indicators and fishing pressure: empirical analysis or modelling to help interpret ongoing trends.

[2] Rochet, M.-J., Trenkel, V., Bellail, R., Coppin, F., Le Pape, O., Mahé, J.-C., Morin , J., Poulard, J. C., Schlaich, I., Souplet, A., Vérin, Y., and Bertrand, J. A. 2005. Combining indicator trends to assess ongoing changes in exploited fish communities: diagnostic of communities off the coasts of France. ICES Journal of Marine Science, 62: 1647-1664.

5. *Advice*: comparing desirable directions and actual trends to suggest appropriate management actions. To this end it would be particularly useful to monitor indicators of fishing activities. Monitoring fishing pressures in detail would help determining possible controls to modify the trajectory of the system.

In the realm of socio-economics the components of the framework are:

1. *Management (policy) objectives*: statement of desirable and/or undesirable states of the social system as it relates to fisheries. This could be determined from policy objectives formulated at different system scales (International, EU, National, Regional, Local, group/metier). Objectives at the different scales could be identified from:
    - *International scale:* Conventions supported by the international community including EU
    - *EU-scale:* CFP social objectives, Environment policy social objectives, social objectives of EU-spatial/territorial policies; social objectives of other relevant EU-policies
    - *Regional trans-boundary (RAC) scale:* Socio-economic objectives stated by Regional Advisory Councils (RACs)
    - *National scale*: Social objectives of relevant sector policies (fisheries policy, environment policy, regional policy etc.)
    - *Local (province/district/commune scale):* social objectives formulated from local social policies and local business development policies.
    - *Group/metier/PO scale*: social objectives to be met from group action/behaviour.
2. *Reference state*: Compared to the desirable social state (where social objectives are met within limitations/constraints related to the state of (natural) resources and level of production technology), a historic *reference state* can be determined as the state of the system at some past time t_b, *e.g.* the year time series of social indicators starts. *Desirable* and *undesirable directions* for social indicator trends can then be identified.
3. *Trend assessment*: combining trends in social indicators to determine whether the system recently moved towards the desirable social state
4. *Relationships* between social indicators and pressure on fish resources (directly from fishing and indirectly from pollution, or other uses of the aquatic environment): empirical socio-economic and institutional analysis and/or modelling to help interpret ongoing trends.
5. *Advice*: comparing desirable directions for social indicators and actual trends to suggest (from well-understood relationships) appropriate management actions.

2.2 Fisheries Policy Objectives and Indicators

Fisheries policy objectives are stated at different political scales ranging from the level of international conventions, agreements and plans of action to the local metier/fisher association level. The sector policy objectives relates to the *utilization of*

fish resources (conservation policy) i.e. natural capital exploitation and preservation, the *fisheries sector structure (structural policy)* i.e. the amount and character/quality of manufactured, human, and social capital and the *institutional arrangement*s *(governance, market policy and other)* (i.e. operational rules, collective choice rules, constitutional rules. In addition fisheries management is expected to contribute to or at least not undermine the attainment of other overall policy objectives/goals that are identified at the same scale levels (e.g. income and employment objectives, cohesion objectives etc.)

At the international level some of the objectives related to the natural capital are general and cutting across all ecosystems (e.g. the WSSD commitments) whereas others are more specific (e.g. International Plan of Action for illegal, unregulated and unreported fishing). Some conventions such as the OSPAR and HELCOM Conventions very specifically address natural capital maintenance. Most objectives at international level related to manufactured, human and social capital are cutting across all fisheries.

The same applies to fishery policy objectives at the EU level. Here natural capital objectives may be specified in general terms as well as at fish species level (fishing mortality rates) as e.g. in EU stock recovery and management plans

At the RAC level it is too early to tell if policy/management objectives on natural capital will be formulated specifically related to fish species and stocks and if objectives on manufactured, human and social capital will be general or fleet segments/metier specific.

At the national level the fisheries policy objectives may be much more specific and relate to individual fish species, discrete fish stocks, fishing vessel segments/metiers, discrete fishing communities etc. This tendency becomes more pronounced the lower the policy level attained.

The link between policy objectives (normative) and management action (regulative) is indicators (cognitive). As decision-makers often have very little time to consider key implications of their decisions and they are often called on to make decisions in fields in which they have limited expertise indicator systems must convey critical information simply and compactly (Rudd 2004). The criteria for indicator selection that have been applied in this case are:

- they should relate to specific management objectives;
- they should respond to management measures within a reasonable time-frame;
- they should be relevant to the scale of management (local, national, regional, international);
- they need to be compatible with management institutions;
- they should be acceptable by all stakeholders in the fishery systems;
- they should be understandable by the public at large;
- they should be understandable in terms of having research-based substance and reflecting analytical soundness;
- they should be understandable in terms of reflecting features in accordance with stakeholders' understanding of the resource system;

- they should be observable within economic resources for research on a sustainable basis;
- they should be observable by stakeholders, either directly or by transparency in the observation process.
  (Degnbol and Jarre 2005)

In the policy hierarchy in Table 1 is listed the main policy objectives related to the CFP from international down to national scale and the element in the fisheries system framework to which it refers (natural capital, manufactured capital, human capital, social capital, operational level, collective choice level, constitutional level). For each objective one or two indicators meeting the above mentioned selection criteria have been identified including the desired direction of the indicator in order to meet the objective.

Table 1 Fisheries policy hierarchy and indicators

Scale	Policy Objectives	Indicators	Desirable direction of indicator (arguable)
International	Fishing effort commensurate with sustainable use of fishery resources[3].	Fishing fleet capacity (no of vessels, tonnage, kw) Total no of fishers	Capacity decreasing (all indicators) No of fishers reduced
	All factors directly or indirectly contributing to the build-up of excessive fishing capacity eliminated[4]	Financial subsidies to vessel investments (amount of money). Access regulation	Subsidies reduced/abandoned Access restricted
	Illegal, unreported and unregulated fishing eliminated[5]	Violations of regulations (nos.) Misreportings (nos.) Unregulated fisheries	Nos of violations reduced Nos of misreportings reduced Nos of unregulated fisheries decreasing

[3] COFI IPOA (1999) (not binding)
[4] Same as 2.
[5] COFI IIU (2001)

EU	Productivity in the fisheries sector increased[6]	Value of fish production/fish worker	Value increasing
	Fair standard of living for people involved in the fishing industry[7]	Income per capita in fisheries dependant communities relative to non-fishing communities or country total	Per capita income in fishing dependent communities increasing
	Markets stabilized[8]	Market take-out by POs	Take-out decreasing
	Fish supplies are available to EU consumers at reasonable prices[9]	Fish consumption per capita Consumer prices for fish products	Fish consumption per capita stable/increasing Fish prices stable relative to meat and others food items
	Fishing activities are efficient[10]	Return on capital invested in fishing fleet, processing industry and aquaculture	Return on investments in fisheries equal to or higher than market rate of return
	Economically viable and competitive fisheries and aquaculture industry[11]	Resource rent and profit margin.	Resource rent and profit margins are stable or increasing
	Fishing effort adapted to level of available resources, taking into account the social impact[12] Equitable, safe and appropriate working and living conditions onboard vessels[13]	Days at sea Nos of accidents	Days at sea decreasing Nos of accidents decreasing

[6] EC Treaty, Article 33
[7] EC Treaty, Article 33 and CFP Council Regulation 2371/2002, Article 2.
[8] Same as 5
[9] Same as 5
[10] Council Regulation 2371/2002, Article 2.
[11] Same as 9
[12] Gothenburg EU Sustainable Development Strategy, June 2001
[13] European Code of Conduct of Sustainable and Responsible Fisheries Practices, 2004. Objective f)

	Social cohesion[14][15][16] -prosperity objective (employment) -solidarity objective (equal opportunities and inclusion)	Unemployment in fishing dependant communities (level and distribution)	Unemployment rate is lower or at level with national average
	Economic cohesion[17]	Income in fishing dependant communities (average income level and distribution)	Income is higher or at level with national average

[14] European Strategy for Social Cohesion, 2005. Indicators are underway.
[15] Communication from the Commission on the Social Agenda, 2005
[16] Strategic Objectives 2005-2009. Europe 2010: A Partnership for European Renewal, Prosperity, Solidarity and Security, COM (2005) 12.
[17] A new partnership for cohesion, convergence, competitiveness, cooperation, Feb. 2004.

National	Working environment is improved[18]	No of accidents	No of accidents is decreasing
	Value adding to fish landings is increased[19]	Share of landings used for human consumption Value of sector output from domestic landings	Share used for human consumption increasing Value of output increasing
	Traceability of products [20]	No of traceability systems implemented	No of traceability systems increasing
	Equal opportunities in coastal areas/islands for: - employment - income generation - education	No of unemployed Income level and distribution No of inhabitants having received formal training and/or education	Unemployment figures are decreasing Incomes are increasing No having received formal training and/or education increasing
	Amounts of discards must be reduced[21]	Amounts of discards compared to the total catch (landings and discards) for selected species	Relative amounts of discards are decreasing
	Size of fleet and composition that is better adapted to catch possibilities	Capacity of fishing fleet segments (tonnage, engine power, etc.) and composition	Capacity of fleet segments adjusted to natural capital state

2.2.1 The Danish pelagic fisheries

The Danish pelagic fisheries for the major part take place in the North Sea. A limited number of vessels are involved in these fisheries, helping make it a discreet and manageable case study. The pelagic fisheries case is also rather straightforward

[18] FIUF 2000-2006 Programming Document
[19] same as 9
[20] same as 9
[21] National Strategy for Sustainable Development

because the vessels catch a relatively limited number of species and interact relatively little with other fisheries. Normally the vessels involved also do not change *metiér* over the year. The Danish pelagic fisheries are considered among the most successful in the EU both in terms of profitability and sustainability of the targeted fish stocks.

The case study exclusively deals with the pelagic fleet in the period from 1990 to 2005.[22] The overall indicator framework also deals with objectives related to the processing industry and the local communities in a broader policy context.[23] However, it has not been possible to pursue these objectives/indicators within the limitations of the INDECO project.

2.2.2 The Pelagic Segment

In the EU legislation on the recently established Pelagic Regional Advisory Council (www.pelagic-rac.org) pelagic stocks are defined as including blue whiting, herring, mackerel and horse mackerel (Council Decision 2004/585).[24]

The definition of pelagic fisheries adopted in the RAC legislation is thus related to the target species. From a socio-economic perspective this is not the most appropriate definition, as it would seem more reasonable to take point of departure in the nature of the fishing methods used. This is also the approach taken in the CFP regulations on the provision of data to the EU Commission.

EU Member States are (or in coming years will be) legally required to collect and provide on a regular basis a number of fisheries related datasets to the Commission. These datasets relate to biological, social and economic aspects of different segments of the fleet. The requirements for the datasets are outlined in a set of regulations - henceforth referred to as the data collection regulations (DCR) which specifies a minimum (obligatory) as well as and an extended programme. The preamble of the EU framework regulation on collection and management of data states that *"*[to *conduct the scientific evaluations needed for the common fisheries policy* [...]*, complete data must be collected on the biology of the fish stocks, on the fleets and their activities and on economic and social issues"* (Regulation 1543/2000). The specific data requirements and confidence levels, are outlined in detail in CEC 2001a (as amended by CEC 2004), which groups data in three modules: 1) module of evaluation of inputs: fishing capacities and fishing effort; 2) module of evaluation and of sampling of catches and landings; and 3) module of evaluation of the economic situation of the sector (CEC 2001a). The DCR represents at the moment the best indicator on quality datasets on social and economic aspects, which will in the future

[22] In practices the period will be determined by availability of data.

[23] For the purpose of this case study we will mainly use statistics from the following sources: statistics available in the databases on the homepage of the Danish Directorate of Fisheries (www.fd.dk); the yearly reports on the development of the Danish ITQ-system for herring (Fiskeridirektoratet and FOI 2004 and Fiskeridirektoratet and FOI 2005); and the yearly account statistics for fishery from the Institute of Food and Resource Economics (www.foi.kvl.dk and Fiskeridirektoratet and FOI 2005 (and earlier issues)).

[24] Capelin and sandeel (and other species) are also to some extent caught by Danish vessels engaged in pelagic fisheries. Sandeel is dealt with by the North Sea RAC and capelin is caught outside EU waters and is therefore dealt with by the high seas / distant waters RAC. Both species are used for industrial purposes. Due to the fact that they are not pelagic species in the context of the RAC regulation they are not dealt with specifically here. However, whenever reference is made to unspecified pools of industrial fish (for instance in relation to catch value), capelin and sandeel are included in the figures.

be available and comparable across Member States. For this reason the present case as far as possible relates to the categories of the DCR

The DCR defines 'segment' as *"a group of vessels as homogeneous as possible in terms of physical characteristics and of use of fishing gear resulting from a partition of the segments contained in the fourth multiannual guidance programme" (MAGP IV)"* (CEC 2001, Article 2). When discussing indicators for certain fisheries or fleet segments it is necessary to relate to EU legislation and definitions. The DCR operates with a number of categories as shown in Table 2, which outlines the required segmentation under the minimum programme.

Table 2 DCR segments – Minimum Programme
Source: CEC 2004, Annex 2

Basic segmentation of vessels for capacities (MP)

Vessel length		< 12 m	12 ≤ 24 m	24 ≤ 40 m	≥ 40 m
Type of fishing technique					
Mobile gears	Beam trawl				
	Demersal trawl and demersal seiner				
	Pelagic trawl and seiners				
	Dredges				
	Polyvalent				
	Others (to be specified)				
Passive gears	Gears using hooks				
	Drift and fixed nets				
	Pots and traps	(1)			
	Polyvalent				
	Others (to be specified)				
Polyvalent gears	Combining mobile and passive gears				
Vessels with no licence					

(1) This segment is aggregated for all passive gears.
Note 1: If a gear category contains less than 10 vessels, then the cell can be merged with a neighbouring length category to be specified in the national programme.
Note 2: If a vessel spends more than 50 % of its time using a specific type of fishing technique, it should be included in the corresponding segment.
Note 3: Length is defined as length over all (LOA).'

Under the *minimum programme* the pelagic segment consists of pelagic trawl and seiners together and is divided in to four groups based on length. Under the extended programme the vessels are divided into more length-categories as well as more fishing techniques, see Table 3.

Table 3 DCR segments - Extended Programme
Source: CEC 2004, Annex 2

Detailed disaggregation of vessels for capacities (EP)

Vessel length			< 10 m	10 ≤ 12 m	12 ≤ 18 m	18 ≤ 24 m	24 ≤ 40 m	≥ 40 m
Type of fishing technique								
Mobile gears	Beam trawl	North Sea ≤ 221 kW						
		North Sea > 221 kW						
		Outside North Sea						
	Demersal trawl and demersal seine	Bottom trawl						
		Danish and Scottish seiners						
		Polyvalent						
	Pelagic trawl and seiners	Pelagic trawl						
		Pelagic seiner and purse seiner						
		Polyvalent						
	Dredges							
	Polyvalent mobile gears							
	Others (to be specified)							
Passive gears	Gears using hooks	Long-lines						
		Other gears using hooks						
	Drift nets and fixed nets							
	Pots and traps							
	Polyvalent passive gears							
	Others (to be specified)							
Polyvalent gears	Combining mobile and passive gears							
Vessels with no licence'								

Under the *extended programme* the pelagic segment is split into three sub-segments based on the type of fishing technique. Each of these sub-segments is divided into six groups based on length. This means that the pelagic segment is divided into 16 sub-groups / sub-segments under the extended programme.

Although the DCR at the moment provides the framework for the future quality indicator datasets that will be available it should be made clear that the framework is just now being tested It is difficult to design a framework that fits all the different fisheries of the EU member states. Therefore, changes will probably be made before the next programming period 2007-2013 starts. It is likely that these changes will also include how the EU fishing fleet should be segmented.

2.2.3 Data Requirements by the Data Collection Regulations

The economic data that the Member States shall make available for each fleet segment under the minimum (obligatory) and the extended programme, respectively, is outlined in Table 4 and Table 5.

Table 4 Economic Information - Minimum Programme
Source: CEC 2001, Appendix XVII (section J)

Economic information per fleet segment as defined in Appendix III (MP)

General description	Extended programme First priority (annual)
Income (turnover)	Total and per species
Production costs: — crew (include social cost) — fuel — repair and maintenance — other operational costs	Total and per production cost category
Fixed costs	Average cost, calculated from investment
Financial position	Share of own/foreign capital
Investment (asset)	
Prices/species (*)	Value, tonne
Employment	Full time/part time/FTE
Fleet	— No — gt — kW — age — gear used
Effort	Relevant unit accounting for technology and time

(*) Quarterly basis everywhere. Aggregated on a regional level 3 in Mediterranean in Appendix I.

The economic information, which is required under the minimum programme, shall be provided for each fleet segment as specified in Table 2. The data provide the possibility to track some trends in the socio-economic performance of the various fleet segments. However, there is no reference to geographical regions within the Member States. Under the extended programme some regionalisation of the data is made, cf. Table 4 but the regionalization is related to sea-areas rather than to regions of the Member States. This means that the data required by the DCR cannot be used to evaluate trends in regions within the Member States and across Member States.

Table 5 Economic Information - Extended Programme
Source: CEC 2001, Appendix XVIII (section J)

Data needs for basic economic evaluation per fleet segment (EP)

General description	Extended programme Second priority
Landings per species	Seasonal (monthly) Stock (by ICES areas) Market category Regional differentiation (level 3, Appendix I)
Income (turnover)	Subsides (annually) Regional differentiation (level 3, Appendix I)
Production costs: — crew — fuel — repair and maintenance — other operational costs	Further subdivision of operational costs Regional differentiation (level 3, Appendix I) Differentiation of remuneration to crew according to position
Fixed costs	Regional differentiation (level 3, Appendix I)
Financial position	Rents to external institutions Regional differentiation (level 3, Appendix I)
Investment (asset)	By type of investment: hull of vessel, various engines and refrigeration/freezing, storage and lifting equipment
Prices/species	Monthly By market category Regional differentiation (level 3, Appendix I)
Employment	Skill/education Distinction per vessel size, regional differentiation
Fleet	Size categories of fleet segments regional differentiation (level 3, Appendix I)
Effort	Regional differentiation (level 3, Appendix I)

2.2.4 The Pelagic Species in the Danish Context

In 2005 the four pelagic species (Council 2004) contributed about 24 percent of the total fish landings by Danish vessels in terms of value. Herring and mackerel are by far the two most important pelagic species. Together they counted for approximately 95 percent of the total value of the landings of all the four pelagic species in 2005 by Danish vessels. In the following the focus is on these two species of which herring is the most important.[25]

The Danish herring catches are predominantly taken in the North Sea (area IV, incl. the Liim Fiord (area IVl)), the Skagerrak (area IIIaN) and the Kattegat (area IIIaS), and the Norwegian Sea (area IIa), see Figure 2.

A minor part of the Danish herring catches are taken in the Sound, the Belt Sea and the Western and Eastern Baltic Sea (ICES areas IIIb, IIIc and IIId). The volume of the landings from these waters in 2004 constituted only 6.3 percent of the total volume of herring landings by Danish vessels. The corresponding value was 5.5 percent of the total.

The Danish mackerel catches are almost exclusively made with pelagic gear in the North Sea (area IV).

[25] The background information on the Danish pelagic fisheries (especially herring) is mainly based on Hegland & Sverdrup-Jensen (Forthcoming), Fiskeridirektoratet og Fødevareøkonomisk Institut (2005) and the website of the Danish Directorate of Fisheries (www.fd.dk).

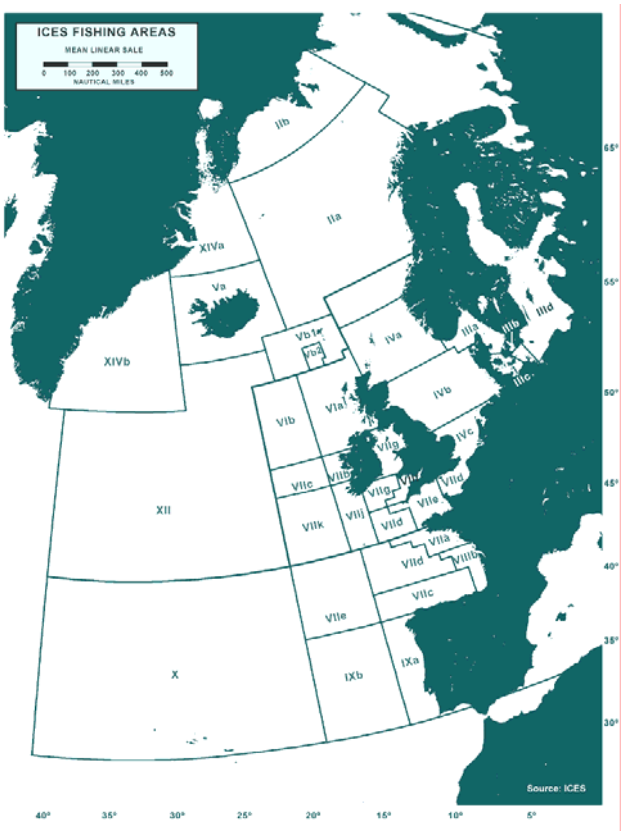

Figure 2 ICES Fishing Areas

The Danish herring and mackerel fisheries are dominated by two gear types: purse seine and pelagic trawl. This has a good fit with the segmentation in the DCR (Table 2 and Table 3). These two types of gear in 2005 represented more than 99 percent of the fishing rights/permits for herring. However, there are big differences as to where the different groups of vessels operate. The smaller vessels exploit the fish resources close to the Danish coasts whereas the larger vessels utilise resources further away.

In the Norwegian Sea purse seiners above 40 meters in length dominate in the fishery for Atlanto-Scandic herring[26]. However, trawlers beyond 40 meters also fish significant amounts of herring in this area. In the North Sea and the Skagerrak the purse seiners and the largest trawlers are joined by trawlers between 24 and 40 meters. In the North Sea all three vessel groups combine catches of herring with catches of mackerel. The tendency is that it is increasingly the larger vessels above 40 meters that catch the mackerel.

In the Kattegat only trawlers between 15 and 40 meters have herring fishing rights. In the Liim Fiord only vessels less than 15 meters may operate. Some of these are trawlers and others are defined as using "one or more of a variety of gears", including Danish seine and gillnets.

Besides the commercial fishing some recreational fishing for herring and mackerel takes place with a variety of gears. The catches in the recreational fishery are

[26] Also known as Norwegian spring spawning herring

probably insignificant in biological terms but the socio-economic importance may be of some magnitude in some areas.

Three distinct pelagic *métiers* can be defined when looking at the total sea area exploited: purse seiners, trawlers and fishing vessels defined as using one or more of a variety of gear. In the Norwegian Sea, the North Sea and the Skagerrak the two *métiers* of trawlers and purse seiners are involved. In the Kattegat only the *métier* of trawling is present. In the Liim Fiord trawlers operate alongside vessels defined as using one or more of a variety of gear. However, this group of vessels in 2005 had less than 0.3 % of the Danish herring fishing permits/rights. As it did not catch any mackerel this segment is insignificant in the context of this case study.

The vessels engaged in the herring and mackerel fisheries are generally targeting other species as well. The trawlers between 24 and 40 meters combine the fishery for herring and mackerel with fishing of various species for fishmeal and oil. A little more than half of the income for vessels between 24 and 40 meters came from a mix of species other than herring and mackerel in 2004. The vessels over 40 meters also combine the fishery for herring and mackerel with fishing of various species for industrial purposes. However, only one quarter of the income for vessels over 40 meters in 2004 came from a mix of species other than herring and mackerel. It is expected that this share will decrease even more in the future where the largest vessels will increasingly specialise in a combination of mackerel and herring fisheries.

2.2.5 Management Practices and Objectives for the Pelagic Fisheries

At the most general level total allowable catches (TACs) and national quotas for herring and mackerel are determined by the EU under the Common Fisheries Policy (CFP) and in negotiations between EU and third countries in relation to shared stocks and stocks in international waters. The CFP imposes other restrictions on the fisheries as well, e.g. mesh-size limits.

However, at national level the Danish quotas for herring in most areas, including the North Sea, are managed by means of individual transferable quota-shares (ITQ). The ITQ-system was introduced in the herring fishery as an experiment from January 2003. Recently it was decided to make the ITQ-system permanent de facto albeit with an eight-year term of notice.[27] On the same occasion it was also decided to introduce an ITQ-system for mackerel and industrial species; this will come into effect shortly.

[27] Herring fisheries in the Sound, the Belt Sea and the Western Baltic and the Eastern Baltic, which are insignificant compared to herring fisheries in other areas, are currently managed by periodical catch limits dependent on the length of the licensed vessel. As from 28 May 2004 Danish fishermen have not been allowed to land herring caught in the Eastern Baltic because of a too high level of dioxin in the fish compared to EU thresholds.

A quota-share is a share of the Danish herring or mackerel quota in one of the ITQ-managed sea areas. Therefore, a quota-share is not a fixed amount of herring or mackerel but depends on the TAC and the Danish quota in the different sea areas[28].

The quota-shares for herring were initially distributed to 95 vessels based on their historic catches of herring in 2000, 2001 and 2002.

The motivation for the introduction of an ITQ-system was that this system would lead to a restructuring of the fleet targeting herring (and mackerel). This restructuring should result in a downsizing of the pelagic fleet in terms of numbers and an increase in the average size of the vessels. The vessels that decided to specialise in pelagic fishing, were expected to be modern and competitive. The yearly evaluations of the ITQ-system for herring indicate that the development has been as expected in relation to restructuring of the fleet. The number of vessels with quota-shares has been reduced from 95 to 48, the average age has been reduced from 30 to 27 years, and the average size of the vessels has increased. This development has taken place within two years and is expected to continue supported by the introduction of ITQs for management of Danish fisheries for mackerel and industrial species. The specific terms of the ITQ-systems for mackerel and industrial species have not yet been decided upon.

The ITQ-system has also resulted in a regional restructuring process. The significance of this restructuring is, however, difficult to measure based on available statistics. The regional distribution is normally measured on the basis of the registration letters of the vessels but this does not say anything about where the vessel is landing the catches. Esbjerg is considered to be the port suffering the most from the regional restructuring processes. Sources within the industry report that there are hardly any vessels left in Esbjerg targeting herring or mackerel. The statistics suggest that Thyborøn port has benefited the most from the restructuring processes. However, Skagen and Hirtshals have also been able to gain from the introduction of ITQs.

It is expected that the redistribution of benefits between regions/ports will be intensified in the future as the ITQ system has been made permanent and is soon to be extended to comprise the mackerel fisheries and the fisheries for industrial species. Furthermore, also the Danish demersal fisheries will from 2007 be managed by means of vessel quota-shares (VQ). There are no restrictions on the transfer of quotas between regions in the ITQ and VQ systems regional concentration and specialization should be expected.

DEVELOPMENT OF QUOTAS AND LANDINGS

A fundamental issue for any fishery is the volume of catch. The catch consists of landings (legal and illegal, see beneath) and discards, see beneath. Figure 3 depicts the development of the volume of registered landings of the four pelagic species (as defined in connection with the RACs) by all Danish vessels. The most notable change is the increase in the landings of herring over the last couple of years - as well as the

[28] Each year an amount of herring is excluded from the calculation of absolute amounts available for quota-shareholders. This amount is used to: 1) cover insignificant catches by vessels not covered by the ITQ-system; 2) provide younger fishermen with a non-transferable quota (for a maximum of three years) without having to buy it; 3) to swap quotas with other countries if fishing possibilities make this practical; and 4) cover possible overfishing by quota-shareholders.

general tendency of the herring landings to fluctuate. The landings of mackerel are in contrast relatively stable, although with a declining tendency, which has, as we shall see later on, (together with other factors) affected the prices especially in the latest years. It is also noteworthy that - in terms of volume - herring is by far the most important of the four species in question.

It is not unlikely that blue whiting, for which quotas have only recently been agreed, will turn out to become a more important asset in the future. Blue whiting could become important in two ways. Firstly, it is the expectation that some of the Danish quota for blue whiting can be traded with other countries for herring quotas. Secondly, there is also an expectation that vessels traditionally fishing mackerel and herring will increasingly take up fishing of blue whiting as a third leg. The reason for this is that blue whiting is available to fish at times when herring and mackerel are not. Furthermore, the recently introduced ITQ system for herring and general problems in the segment focussing on industrial species has led a number of industrial vessels to leave the fishery altogether, which leaves the mackerel and herring vessels with fewer competitors in regards to industrial species.

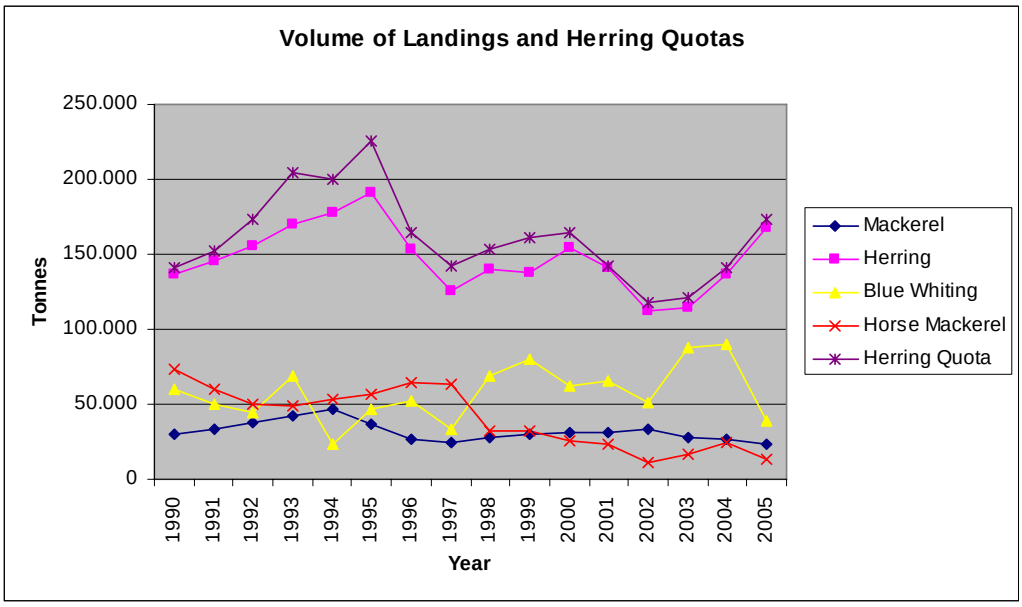

Figure 3 Volume of Landings and Herring Quotas[29]
Source of data: Directorate of Fisheries, www.fd.dk

The extent to which the quota for a specific species is utilised is also important background knowledge. If quotas are underutilised it is less likely that changes in quotas will have socio-economic impact. The development of the Danish quota for herring is depicted in Figure 3 alongside the registered landings. The figure shows that the landings to a very large extent reflect the quotas. In the period from 2001 to 2005 more than 95 percent of the herring quotas have been utilised each year.

This picture is even more pronounced for the other of the most important species, namely mackerel. The mackerel quotas, which are not shown in Figure 3, have been almost fully utilised (around 100 percent each year) in the entire period from 1990 to 2005 (Directorate of Fisheries, www.fd.dk). One of the reasons for the very high degree of match between mackerel quotas and registered landings is the fact that there is full transferability for quotas over sea areas; meaning that the quotas given in one sea area can be caught in any of the other sea areas in which Denmark has mackerel quotas. The mackerel can consequently be caught in the sea area most convenient and where they are available.

It is consequently reasonable to conclude that quota changes for both mackerel and herring will – all things being equal - have direct socio-economic impact in Denmark since the (registered) landings are *de facto* restricted by the quotas. Whether the potential for socio-economic impact materialises or not depends on the development in prices.

[29] The Danish fishery for Atlanto-Scandian herring in the Norwegian Sea did not start before 1995. In 1995 no quota was set, and in 1996 the Danish boats fished from an EU amount of 150.000 tonnes. This makes it difficult to create a time series of Danish quotas versus Danish catches of herring. To solve this problem the Danish 'quota' for Atlanto-Scandian herring for the years 1995 and 1996 has been set to be equal to the actual catches for the year.

DISCARDS AND BLACK LANDINGS

The actual catches consist as stated above of the registered landings, which have already been accounted for in the previous section, plus unregistered ('black') landings and discards.[30]

Unknown amounts of fish worldwide are landed illegally or discarded dead back into the sea and are therefore not recorded in the official statistics. This compromises biological as well as socio-economic data.

The extent to which these phenomena takes place is for obvious reasons difficult to say anything certain about. In the case of the Danish pelagic fisheries it is not possible to provide a credible time series of figures on the amount of unregistered landings or discards. However, it is based on our knowledge of the sector and information from key informants our impression that these issues do not constitute a significant problem in Danish pelagic fisheries.

PRICES AND VALUE OF CATCHES

Volume of catch is important from a biological perspective but of less importance from a socio-economic perspective where what primarily counts is the price paid for the catches. In principle the socio-economic effects of lower quotas / catches should to some extent be offset by higher prices for the smaller landings due to the connection between prices and changes in the balance between supply and demand. However, this is not necessarily the case if the fish species is substituted with another fish species (or a completely different source of protein) or if it is possible to import the same species at a lower price from other countries where the resource is in a better shape. The development of the prices per kilo of the different species can be examined in Figure 4.

[30] Discards can assume different shapes and take place for various reasons. Fish can be discarded because the quota has been exploited for that specific species, or they can be discarded to give room for more valuable (often larger) individuals of the same species, highgrading. Almost all individuals discarded from trawls die. Slipping is a variety of discarding, which has been known to occur in the purse seine fishery, where the fishermen after having tightened the purse seine around a shoal of fish decide to release the catch because they are not big enough or the wrong species, or mix of species etc. How much of the catch, which survives this treatment, depends very much on how much the purse seine has been tightened before release.

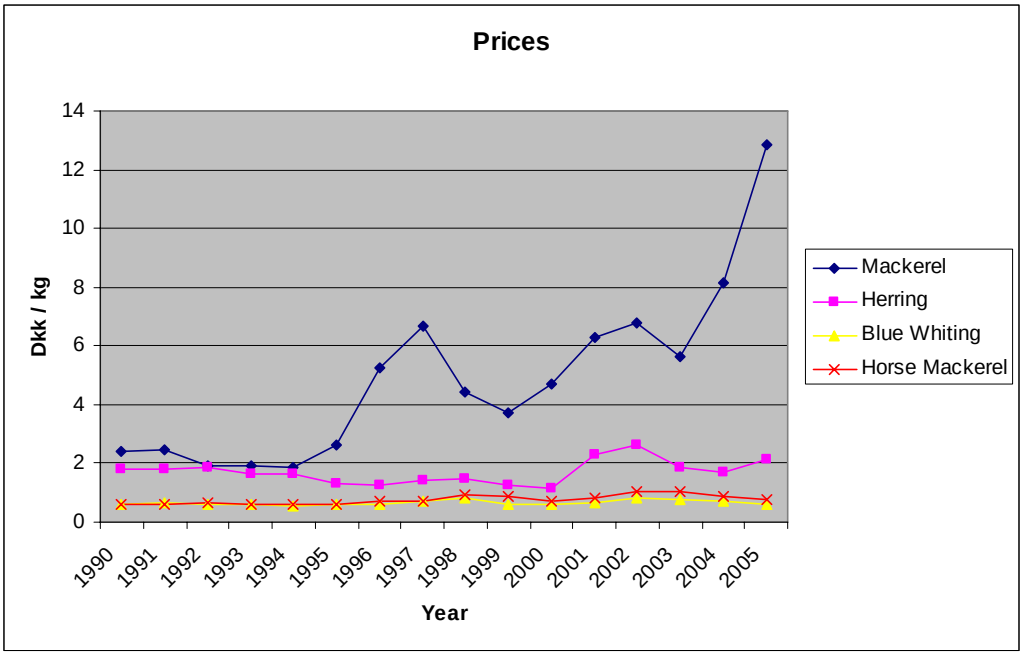

Figure 4 Prices of Pelagic Species Landed by Danish Vessels
Source: Directorate of Fisheries, www.fd.dk

The most striking element in Figure 4 is the prices for mackerel, which have skyrocketed in the last decade and especially the last couple of years. The price per kilo mackerel has increased from a low of DKK 1.85 in 1994 to a record high of DKK 12.80 in 2005. This has happened in response to a 50 percent decrease in the annual catch from the highest point of 46,735 tonnes in 1994 to a low of 23,214 tonnes in 2005. In the same period the market for mackerel in Eastern Europe and Asia has been expanding adding to the upward pressure on prices.

Based on the landings and the prices for the different species it is possible to calculate the value of the combined registered landings of the different species. This has been done in Figure 5, which clearly shows that lower quotas and landings do not necessarily have negative socio-economic effects for the fleet. The overall value of the mackerel catches has been increasing in the period where the landings and quotas have been decreasing.

It is worth noting also that the prices for herring have been increasing in the latest years after a period of low prices in the second half of the nineties. The prices are to some extent controlled by the volume of landings but the relationship is less clear than with mackerel. Part of the explanation for this is that the prices also depend on the amount, which is landed for human consumption *vis-à-vis* for industrial purposes, see Figure 6. Herring landed for human consumption receives a higher price than herring landed for the industry; whether or not herring are landed for industrial purposes is to some extent determined by the specific circumstances in the management system, which is also reflected in the low share landed for industry in recent years. In the later years the legislation has been directly shaped to promote landings for consumption. This is exemplified by the recent ITQ-system, which penalises vessels that do not deliver a satisfactory share to human consumption.

The prices for horse mackerel and blue whiting have been relatively stable in the period, especially if inflation is taken into account.

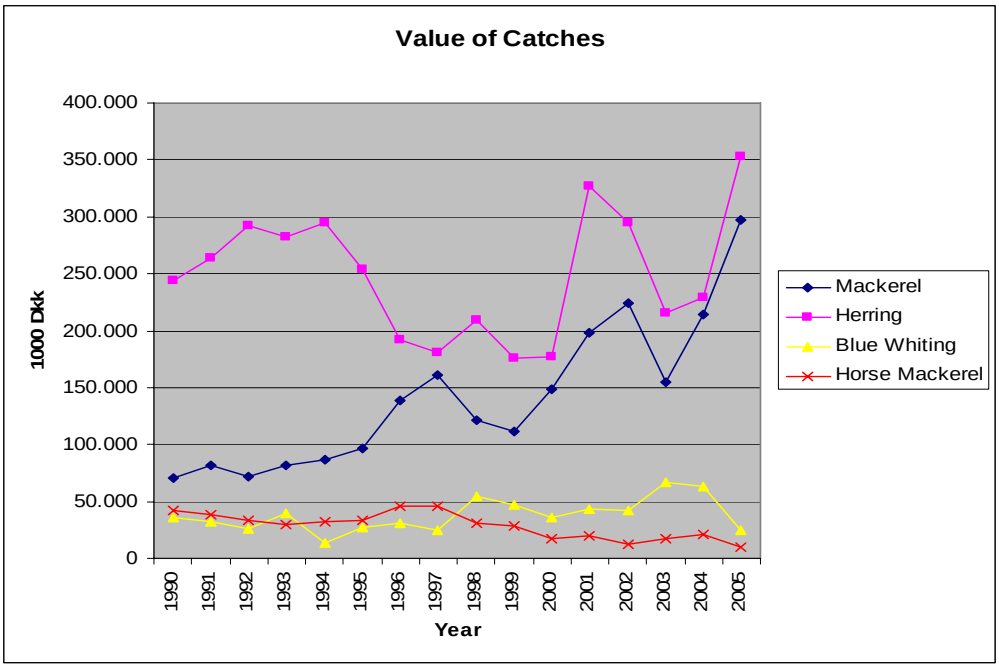

Figure 5 Value of Catches
Source of data: Directorate of Fisheries, www.fd.dk

Figure 5 shows the development in the overall value of Danish catches of the four pelagic species. The overall value of catches is a function of the landings and the prices and it is clear that mackerel and herring remain the dominant species over the entire period. This tendency has become even more pronounced in the latest years, mainly on the background of increasing prices for mackerel, see Figure 4, and increasing quotas for and landings of herring, see Figure 3.

AMOUNT USED FOR CONSUMPTION/MARKET TAKE-OUT BY POS

In general it is preferable that as much as possible of the landed fish is used for consumption rather than for industrial purposes. Especially herring is a species, which is landed both for consumption and for the industry. Mackerel is almost exclusively landed for human consumption and blue whiting and horse mackerel is at the moment generally not used for consumption in Denmark and is thus landed for the industry. The main issue is therefore the use of landed herring, which is depicted in Figure 6.

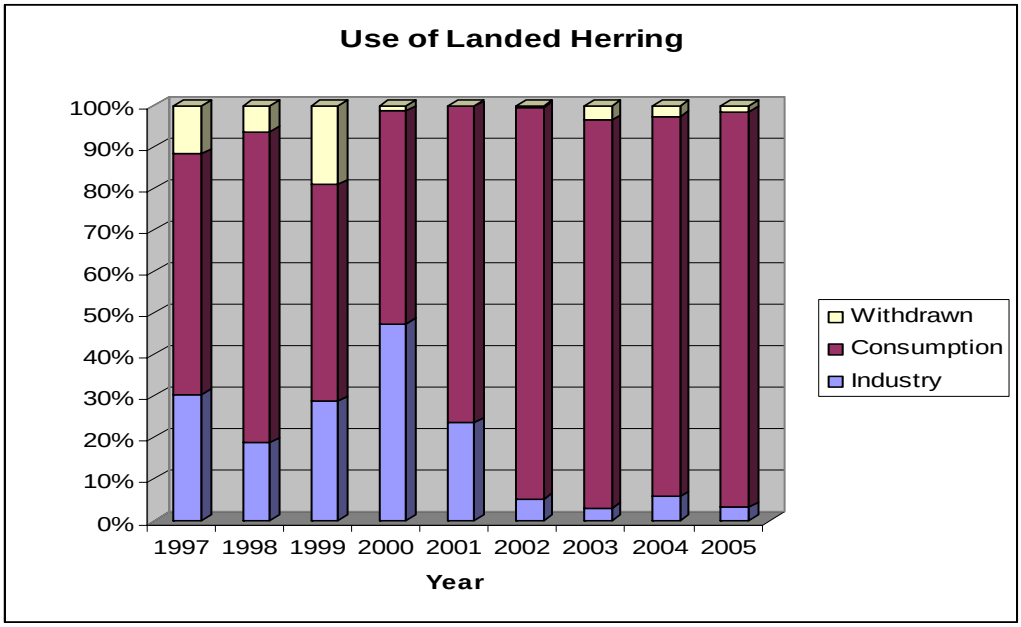

Figure 6 Use of Herring Landed by Danish Vessels
Source: Directorate of Fisheries, www.fd.dk

Figure 6 shows that significant amounts of herring were used for industrial purposes in the period prior to 2002. One of the reasons for this is according to sources in the sector that the management system until recently failed to provide strong enough incentives for not delivering herring to industry. As mentioned above this problem has been attempted solved in recent years for instance by the penalties for delivering too much to herring to industry in the ITQ-system. Figure 6 seems to indicate that the legislative efforts have paid off. From 2002 to 2005 very small amounts of herring have been registered as landed and used for industry.

Figure 6 also illustrates that the amount of herring, which is withdrawn form the market under the EU market policy due to too low prices, has been negligible in the last six years. This is also a step in the right direction.

CAPACITY - AND THE ISSUE OF DELIMITING A PELAGIC SEGMENT IN PRACTICE

Before we can begin to describe the development of the capacity in the pelagic segment we have to discuss how we can isolate this segment in the available statistics.

At present it is not possible to truly isolate a pelagic segment as defined by the DCR in the Danish fisheries statistics. There are several problems linked to the identification of a sharply defined pelagic segment. A main problem is that the Danish vessel register is not considered reliable enough when it comes to the registration of main type of fishing technique. In principle the vessel owners can change their mind and change gear the day after having submitted the questionnaire about their most favoured gear.[31] Although this is probably not the most acute

[31] As a consequence of the shortcomings of the vessel register no distinction is made between for instance bottom trawl, beam trawl and pelagic trawl in most reported statistics. It is therefore not possible in the Danish statistics to isolate all the vessels fitting into the category of pelagic trawlers and seiners. This is especially a problem in relation to vessels under 40 meters. The segment, which in many publicised statistics comes closest to a pelagic segment, is the group of vessels over 40 meters,

problem in relation to the pelagic vessels this issue has strongly affected how statistics are presented in general, see footnote 31.

The best source of data is the Danish account statistics for fishery, which is calculated and presented by the Institute of Food and Resource Economics (FOI, www.foi.kvl.dk). The statistics, which are presented according to a number of categories, are based on a sample of accounts delivered by Danish fishing firms. The sample represents 25% of the population (FOI 2005). The fact that the statistics are based on a sample rather than the whole population results in some uncertainty.[32]

One of the ways that the account statistics are presented is by 'main production category' and one of the main production categories is fishing firms, which are dependent on 'herring, mackerel and industrial species'. The category includes by definition firms where more than 2/3 of the standard catch value comes from herring, mackerel or industrial species and where the industrial species in itself represents less than 2/3 of the standard catch value (Institute of Food and Resource Economics, www.foi.kvl.dk). This means in principle that the category could include vessels, which mainly fish industrial species. However, as Figure 7 shows this segment of fishing firms is as a whole very much dependent on herring on mackerel and to a much lesser degree on industrial species. Furthermore, the amounts of herring and mackerel caught by other production categories are comparatively small, although some amounts are caught by firms otherwise specialised in industrial species; see also Figure 8.

That the group of companies in the main production category of 'herring, mackerel and industrial species' is close to our understanding of the pelagic segment is also supported by Figure 8. When we compare this figure with Figure 5 it is relatively easy to establish that the firms in the main production category of 'herring, mackerel and industrial species' account for 2/3 to more than 4/5 of the value of herring and mackerel landings over the years from 1996 to 2004 – and these are by far the two most important species of the ones we are discussing here.

which are not fishing almost exclusively industrial species. This is to some extent fairly close to a pelagic segment; however, it is probably not including all the vessels, which rightfully belong in the segment, as some of the trawlers less than 40 meters in length are also pelagic trawlers. Unfortunately, it is not possible to identify those in the available statistics divided by length of vessels.

[32] The account statistics has been published every year since the mid-nineties and it is consequently possible to monitor changes over a period of years. However, in some cases there are data breaks because of changes in accounting practices, published statistics etc.

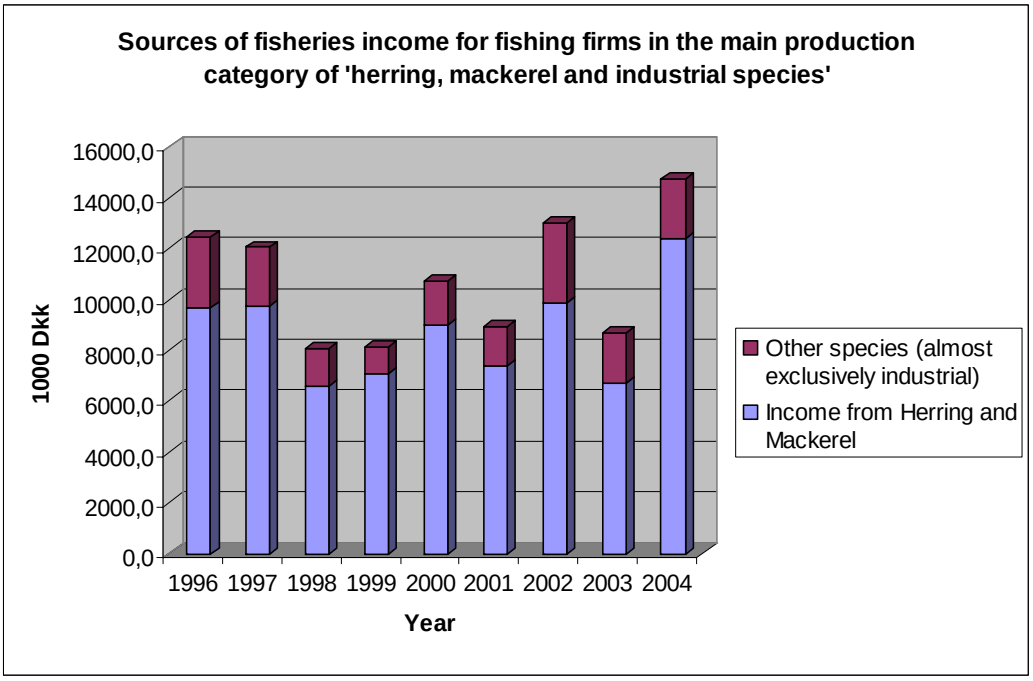

Figure 7 Income in the production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

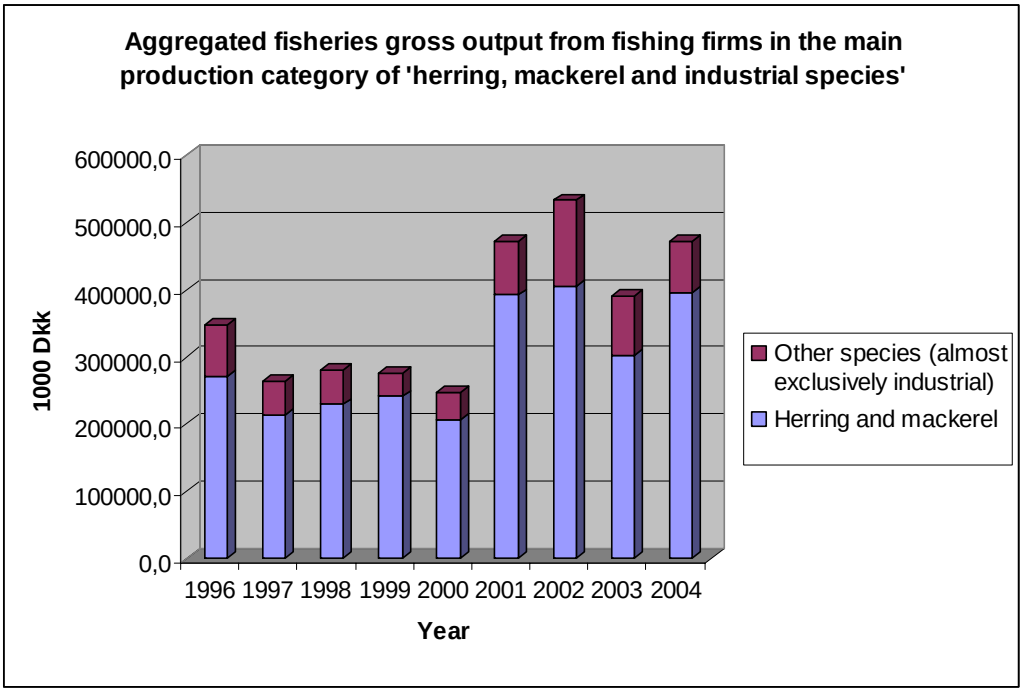

Figure 8 Aggregated fisheries gross output from fishing firms in the main production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

The main production category of 'herring, mackerel and industrial species' is as we discussed above close to our understanding of a pelagic segment. We will in the

following look at the data we can extract from the account statistics for this particular production category. It is our conviction, which is based on discussions with people in the sector, that these figures give a fairly good picture of the overall development in the pelagic fleet segment. This is especially the case in terms of direction of trends.

However, the account statistics is only updated with the accounts for 2004. This means that the account statistics do not provide much information on the results of the introduction of the ITQ-system for herring, which has contributed to a restructuring in the pelagic segment. Another source of statistics for the pelagic segment in the last couple of years could be the yearly reports (2003 to 2005) on the development of the ITQ-system for the Danish herring fishery, which has picked up tendencies that have not been registered in the account statistics yet. However, when we compare the information, which we can draw from the yearly ITQ reports with the information from the account statistics it becomes clear that the data in these reports should be treated with caution. The data in these reports include vessels, which are not pelagic vessels in the sense of being mainly dependent on mackerel and herring. This is because the reports deal with all vessels holding ITQs for herring - no matter how insignificant their share is.

Let us after this discussion on how to delimit a pelagic segment return to the main topic of this section, namely the development of the capacity in the pelagic segment. Let us initially look at the aggregated tonnage of firms in the main production category of 'herring, mackerel and industrial species'. The development in terms of gross registered tonnage (GRT) is illustrated in Figure 9.

Figure 9 Aggregated tonnage in production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

Figure 9 shows that the capacity of fishing firms in main production category of 'herring, mackerel and industrial species' has increased substantially during the period from 1996 to 2004. This was confirmed by sources in the segment. However,

the sources in the segment suggested also that the ITQ system had in the last couple of years led to a reduction of the capacity in the pelagic segment because some boats have taken over the quotas of other boats, which have then left the fishery. This is not reflected by the account statistics, which can possibly be explained by the time lag in the statistics or the uncertainty of statistics based on a sample etc.

Therefore, let us look at the available data about the vessels, which are in possession of ITQs for herring. As mentioned above, yearly reports are being produced on the development and results of the ITQ-system, which was introduced on 1 January 2003. It was expected that the introduction of the ITQ-system would facilitate a restructuring of the fleet segment, which catches herring. Based on the short time-series, which is available, this seems clearly to have been the case. The development from 2003 to 2005 shows that the number of vessels with ITQs has been significantly reduced from 95 to 48 vessels; the reduction is less, but still significant, if total horsepower or total tonnage is considered.

On 1 January 2003 95 vessels held ITQs. The average tonnage of a vessel was app. 340 GRT and the average horsepower app. 980. On 1 January 2004 this had changed to only 77 vessels holding ITQs. The average tonnage of the vessels had increased to app. 375 GRT and the average horsepower to app. 1080. On 1 January 2005 only 48 vessels held ITQs. The average size of the vessels was app. 370 GRT and horsepower 1400. The capacity in the segment holding ITQs has consequently decreased over the latest years. This development can only be interpreted as a reaction to the change in the management system and thereby the institutional environment the fleet has to manoeuvre within. Anyway, it is difficult to use the development in the segment of vessels holding ITQs as a proxy for the development in the pelagic segment as a whole. The reason is the 'noise' created by the vessels that held or hold small ITQs for herring but nonetheless focus mainly on other species.

The information from sources in the sector seem to imply that the capacity in the pelagic segment is on its way down and thereby the trend has changed in response to the introduction of ITQs for herring. ITQs are also being introduced for mackerel and industrial species, which is expected to reinforce the development. Nevertheless, it is not possible yet to detect these changes in the account statistics but it is highly likely that the coming years' account statistics will show a declining capacity in the pelagic segment.

DAYS AT SEA

The number of days at sea for vessels is an indicator of the intensity with which the available capacity, which we have described above, is utilised. Figure 10 is created on the background of the information in the account statistics.

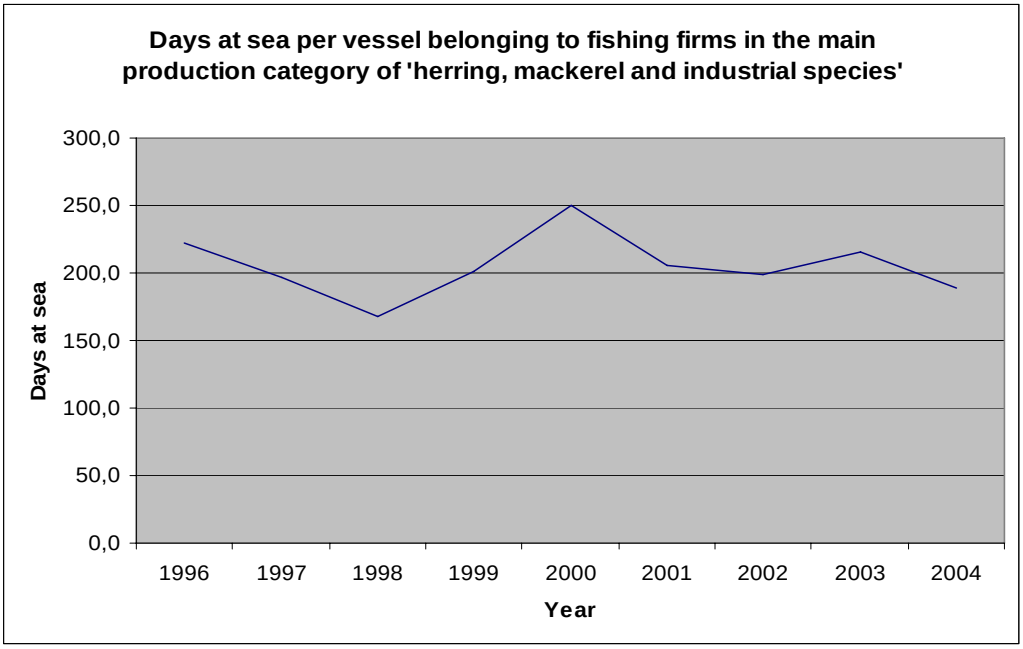

Figure 10 Days at Sea
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

Figure 10 does not provide a clear picture of a trend. There is possibly a tendency towards fewer days at sea since a peak in 2000. Sources in the sector indicated that this seemed credible but the available data does not allow us to make strong conclusions.

NUMBER OF FISHERMEN

Time-series for the number of fishermen, who are specifically dependent on pelagic resources, are - like it was the case with the capacity - not easy to extract from available statistics. The best source of information is once again the Danish account statistics, which include data for the number of working days[33] per fishing firm in the different main production categories. Figure 11 shows the aggregated number of working days in fishing firms in the main production category of 'herring, mackerel and industrial species'.

[33] Working days = number of working days at sea for fisher/owner (the work performed by the owner is not a part of the paid labour input as the owner's remuneration is calculated by deducting an estimated capital interest from the operating profit) *plus* number of working days at sea for partners/shareholders *plus* number of working days at sea for hired skipper plus number of working days at sea for hired crew plus other working days (all work performed on days where the fishing vessel is not at sea, e.g. work on preparing for fishery, maintenance or administration). (FOI 2005)

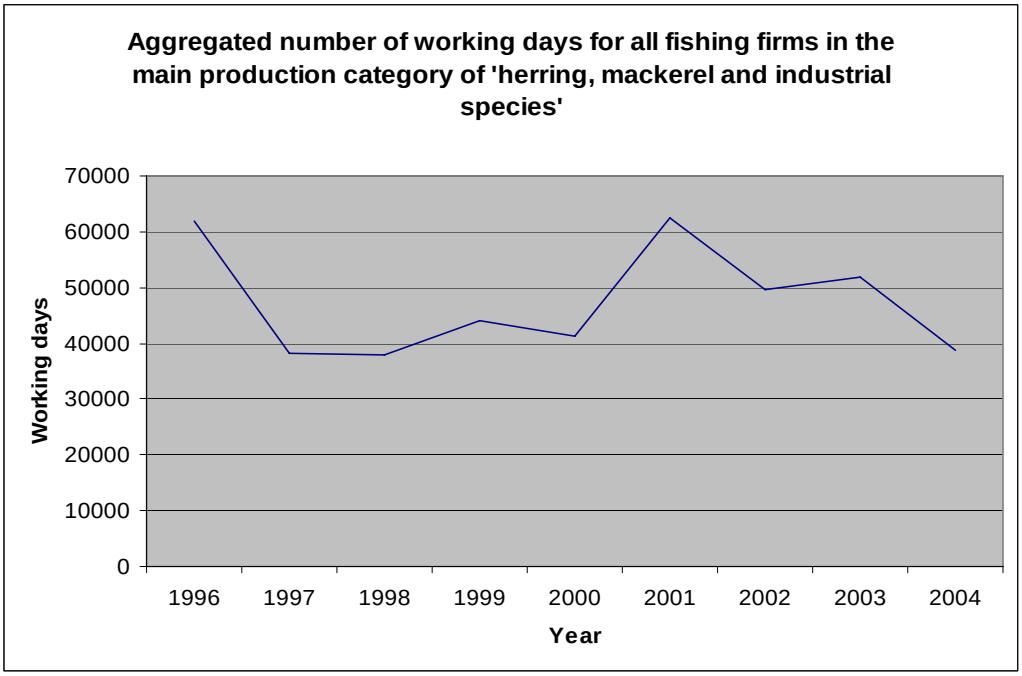

Figure 11 Aggregated working days in fishing firms in the main production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

Intuitively one could think that the number of worked days at sea is an indicator for the number of persons employed; so that when the number of worked days goes up, the number of employed persons goes up, too. However, according to sources in the sector this would be a false assumption, which fails to take into consideration the special arrangements in the fisheries sector regarding employment and salary. As an example, one source told us that he would have the same number of persons employed even if the number of days at sea for the vessel increased substantially (and the number of working days performed thereby increased too). The employees would just get a better salary - at least if the increased number of days at sea resulted in a larger value of catches. Consequently, at present no data exists, which can in a credible way provide us with figures for the employment in a specific segment. It is at best possible to provide figures for the fishing sector as a whole.[34]

Figures from Statistics Denmark (published by the Directorate of Fisheries, www.fd.dk) suggest that the number of employed in the sector as a whole has decreased substantially in the last three to four years. However, it is not possible to say much about the development in the pelagic segment alone. Based on the development in capacity the development has probably not been as negative in this segment.

NUMBER OF UNEMPLOYED

At the moment it is not even possible to get data on the number of unemployed in the fishery sector as a whole. Getting information on the number of unemployed from a specific segment like the pelagic is even more unlikely. Especially since most of the

[34] This reflects the conclusion of the European Commission, which has recently commissioned a project with the objective of looking into these issues.

people who would be seeking job in the pelagic segment would also be seeking employment on large demersal vessels and it would probably be impossible to ascribe the unemployed fishermen to a specific segment due to the continuing restructuring of the sector. It might be possible to create rough estimates of unemployment in the fishery sector as a whole by using different registers but it is not done routinely and the resulting data would be subject to a number of caveats. Anyway, this does not help us in relation to the pelagic segment.

VALUE OF FISH PRODUCTION PER FISH WORKER

Productivity is a traditional economic indicator. In the case of the pelagic segment it is not possible to find data on the value of fish production per fish worker. It is as described above extremely difficult to estimate the number of employed persons in the pelagic segment in a credible and comparable way; anyway, data on the number of working days and the fisheries gross output[35] is available (see Figure 8 and Figure 11).
The development of fisheries gross output per working day can be examined in Figure 12.

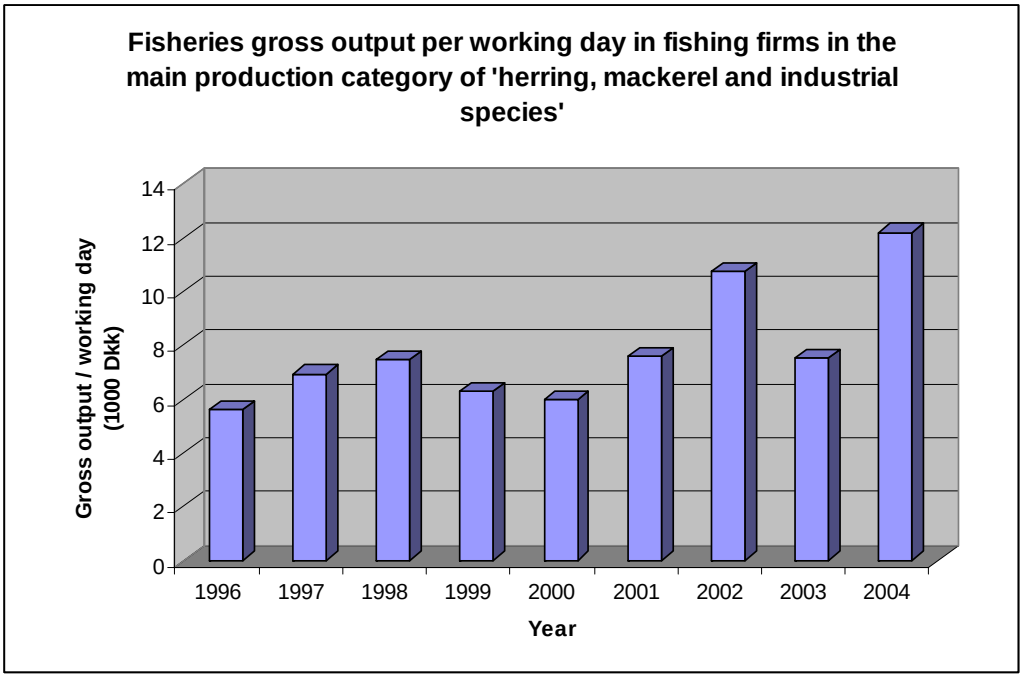

Figure 12 Fisheries gross output per working day in fishing firms in the main production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

Figure 12 shows clearly a positive trend. The productivity of a working day has increased substantially over the period. This is probably related to a combination of different factors. The development in prices of particularly mackerel has been positive in the period, see Figure 4, and it is also likely that the average size of vessels in this segment has increased, which will usually mean that the productivity per manual working day will increase.

[35] Fisheries gross output = gross output, excl. subsidies and non-fisheries income.

INCOME DIRECTLY GENERATED FROM THE FISHERY

The income generated from the fisheries is of importance for national economy. In this relation the direct income generated from the pelagic sector (defined by the FOI, as discussed in relation to capacity) are defined as the salaries for employed fishermen and the part-owners share of outcome.

Seen in the 9-year perspective 1996 to 2004 the income generated from the pelagic fisheries has increased in absolute terms. From 1996 to 2000 the income decreased, from 2001 to 2002 it increased, with a new decrease in 2003 – Figure 13.

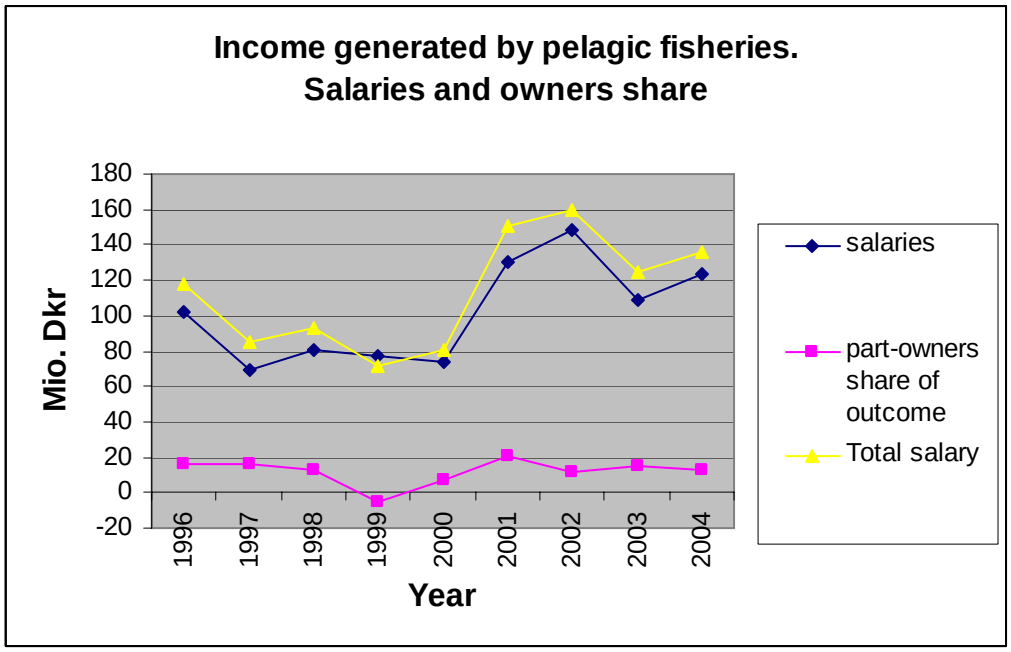

Figure 13 Income generated by pelagic fisheries. Salaries and owners shares in the production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

RETURN ON INVESTMENTS/RATE OF RETURN

The rate of return[36] is an indicator of how attractive a specific sector is for investors. To attract investments a firm has to be able to provide a rate of return, which over a period of time is comparable to the rate of return in other firms in the same or other sectors. Figure 14 provides an overview of the development of the rate of return for vessels in the main production category of 'herring, mackerel and industrial species'.

[36] Rate of return calculated as operating profit deducted by owner's remuneration, as a percentage of fishery assets at the beginning of the year. Operating profit = gross output minus costs. From 2001 are the working partners or shareholders remuneration not deducted from the operating profit. Remuneration to the owners: if more than one owner is active (working) the wages present in the accounts are used, otherwise the remuneration are calculated as number of working hours times 191 DKK (for 2004). Labour input is counted as number of days at sea multiplied by an individually estimated average number of hours worked per day at sea. To this amount is added an estimated number of hours worked by the fisherman on other days). (FOI 2005)

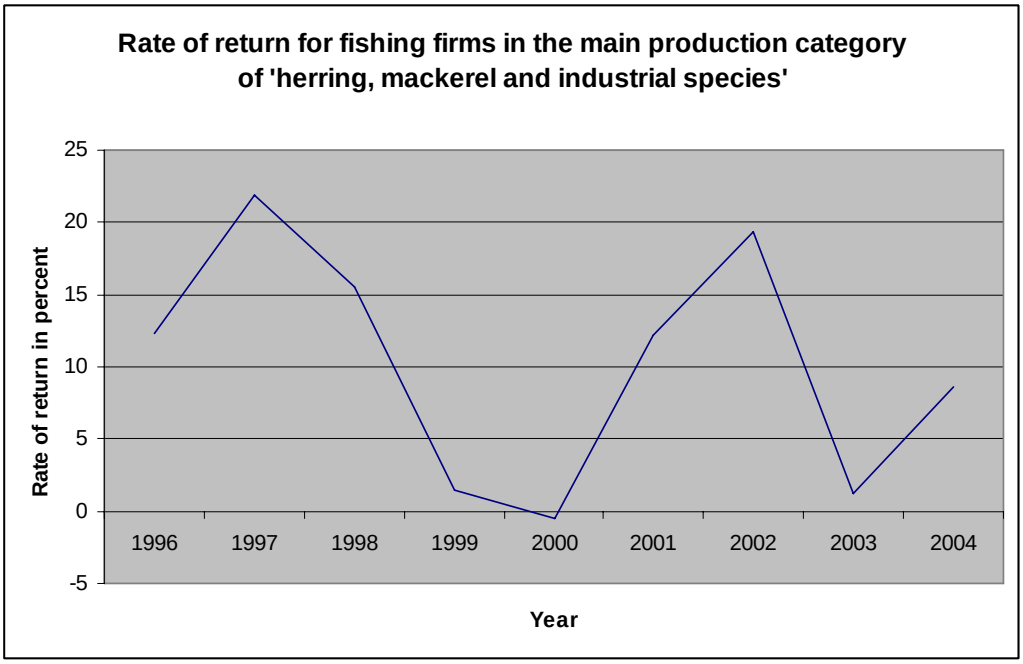

Figure 14 Rate of return for fishing firms in the main production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

Figure 14 shows that the rate of return fluctuates. If we compare with other tables it seems clear that the fluctuations are to some extent related to the availability of quotas. However, the fluctuations is probably also related to the prices on oil, which is one of the main variable costs involved in fishing. We have, however, not tested this relationship directly.

SUBSIDIES

The aggregated amount of subsidies[37] and one-off subsidies[38] to fishing firms in the main production category of 'herring, mackerel and industrial species' is illustrated in Figure 15 and Figure 16.
It should be emphasised that the available data does not include indirect subsidies like exemption from taxes on fuel; fish paid for and removed from the market under the price support mechanisms of the EU market policy etc.

[37] Subsidies include for instance subsidies to vessels participating in research fishery or transport subsidy to firms resident on isolated islands. (FOI 2005)
[38] One-off subsidies include for instance subsidies to modernize the vessel. (FOI 2005)

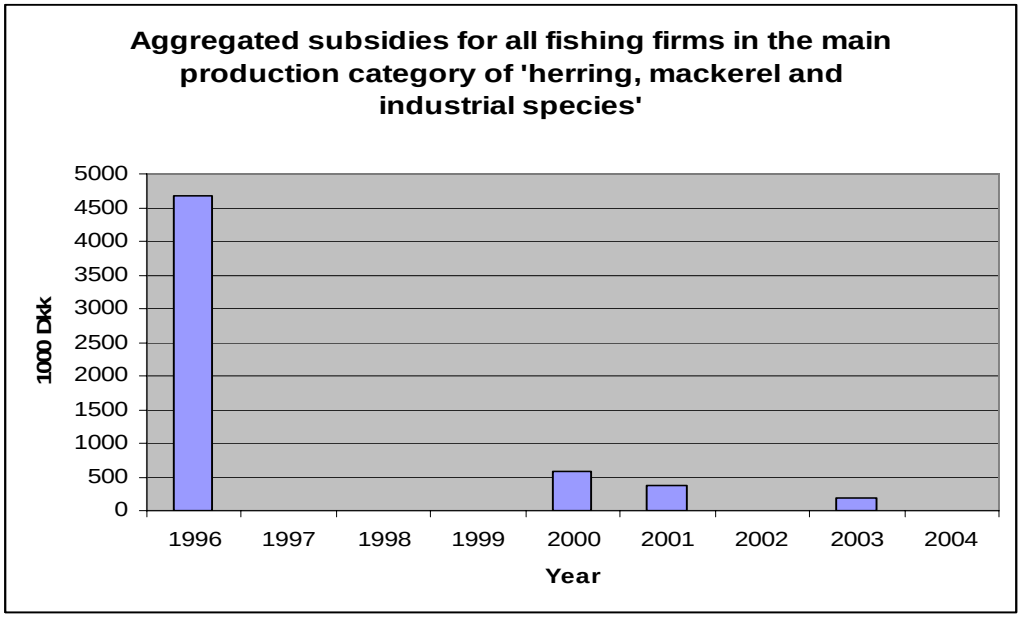

Figure 15 Aggregated subsidies for all fishing firms in the main production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

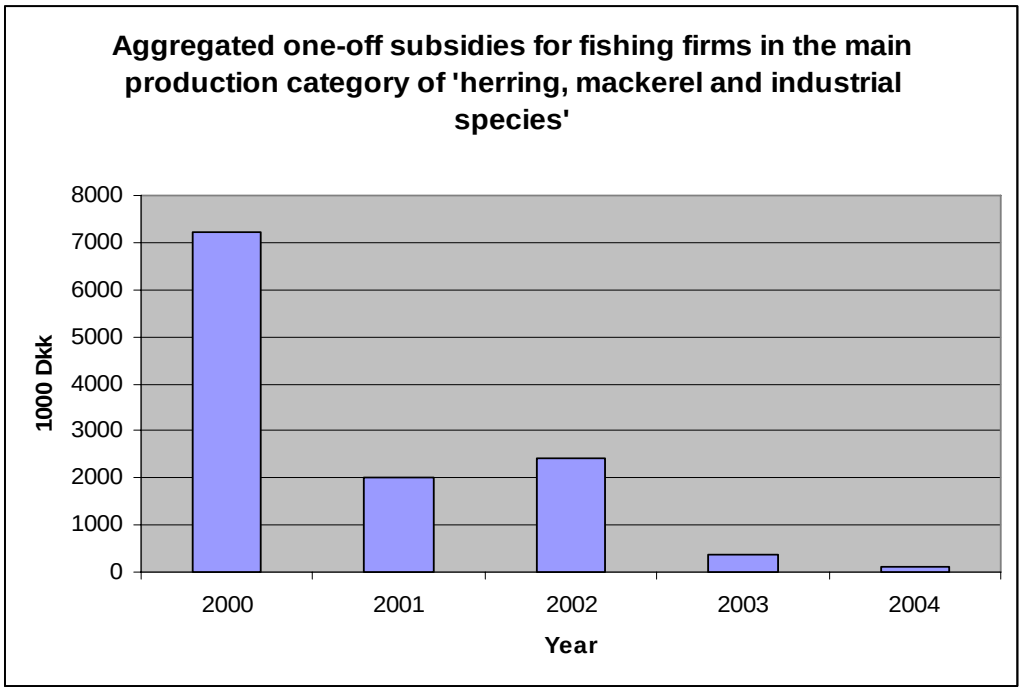

Figure 16 Aggregated one-off subsidies for all fishing firms in the main production category of 'herring, mackerel and industrial species'
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

Two basic messages regarding direct subsidies for the pelagic fleet can be drawn from Figure 15 and Figure 16. First, it can be said that the amount of subsidies seems very modest compared to the value of landings. Second, the trend is clearly that the amount of subsidies is on its way down. The conclusion must be that direct subsidies are increasingly not an important issue in a discussion of the Danish pelagic fisheries.

ENERGY CONSUMPTION

The use of energy in the fleet shows a tendency to decrease (measured in litre per 100 DKr gross proceeds). Whether this is a general trend is not possible to say, as only data for 5 years are available.

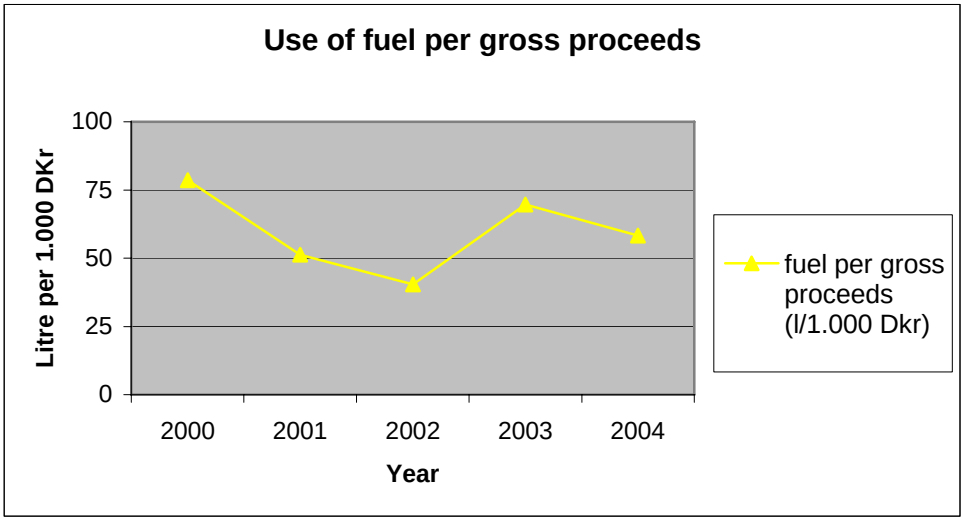

Figure 17 Use of fuel per gross proceeds in the pelagic fisheries (all fishing firms in the main production category of 'herring, mackerel and industrial species'). In litre per 1.000 DKK of gross proceeds
Source: Fisheries statistics by main production categories, Institute of Food and Resource Economics, www.foi.kvl.dk

2.2.6 Application of the Indicator Framework on the Pelagic Case Study

In general the datasets presented above paint a illuminating picture of the development of the pelagic segment in the last 10 years time. This was confirmed by sources within the sector. However, the lack of relevant data for the chosen indicators emerged – not quite unexpectedly – as a major issue. We found in the pelagic case problems in relation to data availability in regards to a large number of the suggested indicators. The difficulties encountered were of various characters.

On a general level a reoccurring problem was that the data, which is available for fisheries, is not detailed enough (at least not publicly available) to be related to the pelagic segment, as defined in the case. In the cases where more detailed statistics were available these were often related to segments, which did not correspond to our definition of the pelagic segment. As an example, in Denmark a lot of statistics is organised mainly according to length of vessel. This meant that we in the case had to use statistics, which were closely related to but did not quite match the pelagic segment, as we defined it. An example of this is our use of data on the main production category of 'herring, mackerel and industrial species' for many of the data on especially economy. This problem could to some extent be overcome if we had had access to the raw data, which we unfortunately had not. In the Danish case this would, however, not have solved the problem completely, as a main problem is that the Danish vessel register is not considered reliable enough when it comes to the registration of main type of fishing technique. In principle the vessel owners can change their mind and change gear the day after having submitted the questionnaire

about their most favoured gear. As a consequence of the shortcomings of the vessel register it has not been considered feasible to make a distinction between for instance bottom trawl, beam trawl and pelagic trawl in most reported statistics. This clearly affects the usefulness of the data.

A main lesson in relation to the abovementioned issues is that the delimitation of a specific fleet segment in terms of the type of fishery/metier/gear remains a major challenge. This has proven to be the case even though the pelagic segment was chosen because it seemed manageable in this respect.

Another problem is the fact that the time series available were often very short, dating only a few years back. This was in some cases related to changes in reporting practices, which made earlier datasets incomparable with newer. In some cases the nature of the change in the accounting practice was, furthermore, not presented in a way, which made it possible to determine the implications of it. A more specific but related problem was the fact that, according to sources in the sector, prevalent forms of wages change over time with changes in management systems, potentially disturbing time series continuously.

It was also the experience that it was in some cases difficult to find out how a specific dataset was arrived at, which naturally made it difficult to compare with other figures and establish the reliability and validity of the datasets in question. And some data was simply not available for the fisheries sector at all. This was for instance the case with data on unemployment, which is not registered for this employment group in Denmark.

However, it is our conviction that the majority of the data availability problems could in principle be overcome for the Danish pelagic sector in isolation; but it will be relatively costly to gather the data in the necessary level of detail for all sectors of an industry, which is of limited importance in most areas of Europe. Moreover, the Danish pelagic case is an isolated Danish case, which does not highlight the problems of comparability across countries. This must be considered an issue, which is potentially just as or even more challenging as the issue of data availability. This was also confirmed by conversations with people working on developing the DCR.

An application of the pelagic case in relation to the overall indicator framework presented in Ch. 2 can be found in Table 6 below. It has to be underlined that the case study has focussed on the fleet only. While the framework suggests that a full case study should include fish processing sector and the local communities as well, this has not been possible within the context of the INDECO project.

Table 6 The Indicator Framework and the Pelagic Case Summed Up

Scale	Policy objectives	Indicators	Relevance for the pelagic case?	Data availability (data source)	Direction of indicator in the pelagic case
International	Fishing effort commensurate with sustainable use of fishery resources[39].	1) Fishing fleet capacity (no of vessels, tonnage, kw)	Questionable as pelagic resources are within safe biological limits	Problem in defining segment. Only economic data available (FOI). Further specification of the fleet is not available.	Aggregated tonnage increasing 1996-2004.. However, the total no, tonnage, and kw of vessels holding herring ITQs has decreased significantly since introduction of ITQs in 2003.
		2) Total no of fishers	As above	Not available for segment	na
		3) Total no of days at sea	As above	Available in economic data	No clear trend 1996-2004
	All factors directly or indirectly contributing to the build-up of excessive fishing capacity eliminated[40]	4) Financial subsidies to vessel investments (amount of money)	Yes, but of minimal importance	Yes (FOI)	Subsidies decreasing 1996-2004..
		5) Access regulated	Questionable as pelagic resources are within safe biological limits	ITQ registers	Access restricted in all pelagic fisheries 1996-2004
	Illegal, unreported and unregulated fishing eliminated[41]	6) No. of violations of regulations (by type of violation).	Yes	No data available – for pelagic fleet segment	-

[39] COFI IPOA (1999) (not binding)
[40] Same as 2.
[41] COFI IIU (2001)

EU	Productivity in the fisheries sector increased[42]	7) Output per working day	Yes	Data available from FOI	Gross output per working day increasing 1996-1998 and 2001-2004
	Fair standard of living for people involved in the fishing industry	8) Income per capita in fisheries dependant communities relative to non-fishing communities or country average	Yes	Salary data for pelagic segment available from FOI.	Salaries constant 1996-2000 and increasing 2000-2004
	Markets stabilized	9) Market take-out by POs	Yes	Yes (herring) (FD)	Significant (up to 20%) 1997-1999. Insignificant (less than 3%) 2000-2005).
	Fish supplies are available to EU consumers at reasonable prices[43]	10) Balance of fish supply	Yes – national level	Fish consumption data by fish species are not available	-
		11) Consumer price for fish	Yes – national level	Data on consumer prices by fish species are not available	-

[42] EC Treaty, Article 33
[43] Same as 5

	Fishing activities are efficient[44]	12) Return on capital invested in fishing fleet, processing industry and aquaculture	Yes	Yes	Rate of return 1996-2004 fluctuating between 0-22%.
	Economically viable and competitive fisheries and aquaculture industry[45]	13) Resource rent and profit margin	Yes	Yes	Resource rent/profit margin high in some years
		14) Unit value of fish production	Yes	Danish Directorate of Fisheries	Mackerel price increa-sing 1999-2005.. Herring price fluctuating 1999-2005
	Fishing effort adapted to level of available resources, taking into account the social impact[46] Equitable, safe and appropriate working and living conditions onboard vessels[47]	15) Total fishing fleet capacity (vessel no, tonnage, engine kw)	Yes	Same as 1 above .	-
		16) Nos of accidents onboard fishing vessels	Yes	No data is available at segment level.	-
	Social cohesion[48][49][50] -prosperity objective (employment) -solidarity objective (equal opportunities and inclusion)	17) Unemployment in fishing dependant communities (level and distribution)	No	No unemployment data is available at fisheries sector/ seg-ment level	-

[44] Council Regulation 2371/2002, Article 2.
[45] Same as 9
[46] Gothenburg EU Sustainable Development Strategy, June 2001
[47] European Code of Conduct of Sustainable and Responsible Fisheries Practices, 2004. Objective f)
[48] European Strategy for Social Cohesion, 2005. Indicators are underway.
[49] Communication from the Commission on the Social Agenda, 2005
[50] Strategic Objectives 2005-2009. Europe 2010: A Partnership for European Renewal, Prosperity, Solidarity and Security, COM (2005) 12.

	Economic cohesion[51]	18) Income in fishing dependant communities (average income level and distribution)	No	No income data is available at fisheries sector/ segment level.	-
National	Working environment is improved[52]	19) No of accidents	Yes	No data available at segment level[53]	-
	Cleaner technologies are applied[54]	20) Energy consumption per gross proceeds	Yes	Data available (2000-2004) FOI.	Decreasing 2000-2002 . Increasing 2002-2004
		21) Waste water quality	No	No data available for segment	
	Value adding to fish landings is increased[55]	22) Share of landings used for human consumption. Value of sector output from domestic landings	Yes – esp. herring	Yes	Use of herring catch for fishmeal and fish oil production between 18 and 45% in the years 1997-2001. From 2002 below 3%.
	Traceability of products[56]	23) No of green-labelled products (alternatively share of production)	Yes	No segment data available	-

[51] A new partnership for cohesion, convergence, competitiveness, cooperation, Feb. 2004.
[52] FIUF 2000-2006 Programming Document
[53] Accidents at work are registered at a level of NACE 4-digit. At this level one cannot distinguish between segments within the fisheries. This means that it is not possible to identify the number of accidents at work in the pelagic fleet. At EU level accidents at work are registered in the Eurostat database European Statistics on Accidents at Work. At the moment the accidents at work are registered in nine main branch groups. Fisheries are not one of the nine branches, and some of the member states do not register accidents within the fisheries. It is not likely that data on accidents at work in segments of the fisheries will be available at EU level in near future.
[54] same as 9
[55] same as 9
[56] same as 9

	Equal opportunities in coastal areas/islands for: - employment - income generation - education	24) No of unemployed	Same as 17 above		-
		25) No of new/lost work-places	Yes		-
		26) Development in fishery generated income 27) Development in nos having received training/education	Same as 8 above No	 No data is available at segment level	
	Amounts of discards must be reduced[57]	28) The amount of discards compared to the total catch (landings and discards) by species	Yes	No – data on discards in the pelagic segment is available.	
	Size of fleet and composition that is better adapted to catch possibilities	29) Capacity of fishing fleet segments (tonnage, engine power, etc.) and composition	Same as 1 above		-

[57] National Strategy for Sustainable Development

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