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INDUSTRIAL FISHERIES IN THE NORTH SEA AND

IN THE SKAGERRAK AND KATTEGAT

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1. NORTH SEA INDUSTRIAL FISHERIES IN THEIR CONTEXT

1.1. International overview

Industrial fisheries are characterised not so much by the fishing gear or technique used, but by the reduction into fish meal and oil of the fish they land. The most important of the world's industrial fisheries developed during and after the 1950's along the coasts of North America, South America, and Africa, where strong semi-permanent upwellings bring to the surface of the sea cold, nutrient-rich water. This allows the proliferation of phyto and zooplankton which supports large stocks of small pelagic species such as various types of anchovies, sardines and pilchards on which industrial fisheries are targetted. The fish are caught predominantly with small-mesh purse-seines and mid-water trawls.

Industrial fisheries have also developed in sub-arctic regions such as the east coast of Canada, Iceland, the seas between Iceland and Norway, the Norwegian coast and the European continental shelf to the south of Norway. Various target species are exploited in these fisheries. Some of these are predominantly bottom-dwelling (Norway pout), others are semi-demersal/semi-pelagic (sandeels, blue whiting, capelin) while others are totally pelagic (sprat, herring). The major gears employed to exploit these stocks are small-mesh bottom trawls, midwater trawls and purse seines.

Particularly in the major industrial fisheries of the world, technological improvements over the last thirty years have made industrial fisheries increasingly effective. Sophisticated electronic fish-finding devices now allow more succesful tracking and netting of fish schools, while powerful fish pumps speed up operations by allowing the direct pumping of the fish from the bagged net or from the cod end directly into the fish holds and, when unloading, from the fish hold directly into the conveying system of fish meal factories. Most vessels participating in these fisheries are large purse seiners, which their operators do not hesitate to lengthen in order to increase storage capacity and to which various mechanical augmentations are made to facilitate manoeuvering. Although smaller and poorly equipped vessels may also participate in some smaller-scale fisheries, the general public perception of these industrial fisheries is that of large and well equipped vessels returning overloaded with fish to disgorge their bounty into the storage tanks of a highly mechanised industry.

The landings of these fisheries are reduced into fish meal and oil in proportions depending upon the species caught, the period of the year and of the point in the life cycle of the fish when caught. It is generally estimated that for each unit of weight of raw fish reduction yields about 20% in fish meal and between 5% and 10% in fish oil, the remainder of the weight consisting mainly of water.

In many instances, landings of the target species of industrial fisheries are processed together with fish landed for human consumption which could not be sold for that purpose because of low quality or low market demand. In addition, offal from the processing of fish for human consumption (guts, heads, skeletons) and other species taken as by-catch by the industrial fisheries but inextricably mixed with the target species are also processed into meal and oil.

Fish meal is used either as a directly administered foodstuff in aquaculture, or in the husbandry of cattle or poultry or it is incorporated into compound animal and fish feed. Approximately two thirds of the world production of fishmeal goes to poultry feed and the rest to cattle, pigs and fish feed. World fish oil production is for the most part incorporated into margarine and other products for human consumption (table spreads, solid cooking fats, health foods) or incorporated into fish feed, as an alternative to vegetable-based sources of oil and fat, either because of nutritive

advantages or because of its relative cheapness. Fish oil may also be added to paints or to the fuel used and burned in power stations.

Although proteins of vegetable origin may be used as substitutes for fishmeal in animal feeds, they do not act as perfect substitutes in aquaculture. Fish meal and oil are essential for feeding farmed fish because they contain a number of organic compounds of planktonic origin which fish are unable to synthesise (polyunsaturated Omega-3 fatty acids).

1.2. General characteristics of industrial fisheries in the North Sea and Skaggerak and Kattegat

For the purpose of the present report, the definition of Industrial Fisheries adopted by the Industrial Fisheries Working Group of ICES is maintained. According to the Working Group, industrial fisheries are "fisheries with small-meshed gear for reduction purposes". This definition thus excludes:

- fish caught for human consumption but used for industrial purposes, as long as this is due to temporarily unfavourable market conditions
- fish caught by small-meshed trawl but landed for human consumption, since this fish is not reduced into fish meal
- fish landed for industrial purposes from gear other than small-meshed trawls, first because this fish is normally caught with the same standard mesh size (appropriate for the target species) as that caught for direct human consumption, and second because this type of fishing activity is negligible or non-existent in the North Sea and Skaggerak and Kattegat.

Industrial fisheries are pursued in the North Sea and adjacent waters, including the Skaggerak and Kattegat, predominantly by Denmark but also by other Member States and by Swedish, Norwegian, Icelandic and Faroese vessels.

The main targets of The North Sea and Skaggerak and Kattegat industrial fisheries are Norway pout, sandeels and sprats. Community regulations permit fishing for these target species, which grow to low maximum length, with the small mesh sizes required to catch them.

Preliminary 1991 landings figures from the industrial fisheries for sandeel, sprat and Norway pout in the North Sea were reported by ICES as 1.35 million tonnes, slightly lower than the maximum of 1.5 million tonnes reported for 1989, but about the same size as the average over the 1974-90 period. These figures also include by-catches of herring and blue whiting.

Landings from Division IIIa (Skagerrak & Kattegat) represent 7.2% for 1991 (97,000 tonnes), and slightly less than 13% in average (164,000 tonnes) of the North Sea landings.

According to the Union of Fish Meal and Oil Manufacturers average EC production between 1987 and 1990 amounted to some 530,000 tonnes for fish meal and 130,000 tonnes for fish oil. This corresponds to total landings of approximately 2.65 million tonnes, including waste products and fish withdrawn from the markets. In 1990, Denmark was the leading producer among the five major EC producers with almost 60% of total EC production (75% for fish oil), followed by Spain (about 18%), the UK (13%), Germany (7%) and Ireland (about 3%). Among other European producers, Norway (198,000 tonnes) and Iceland (192,000 tonnes) follow Denmark (338,000 tonnes)

EC production figures should be related to and compared with consumption figures. The same sources indicate that EC consumed about 1,039,000 tonnes of fish meal and 610,000 tonnes of fish oil. This implies that the EC imports approximately as much fish meal as it produces and almost 5 times as much fish oil. Last but not least EC fishmeal production of 530,000 tonnes should be compared to a world production of more than 6.7 million tonnes and to the production of countries such as Peru, Chile and Japan which in each case is superior to 1 million tonnes.

2. THE INDUSTRIAL FISHERIES CONTROVERSY

Even before the inception of the CFP, industrial fisheries, particularly those in the North Sea and Skaggerak/Kattegat, were already at the heart of a major controversy between those who believed that such fisheries are in some way(s) harmful and/or that the reduction of any fish to meal and oil is in some way(s) wasteful and those who believed that the existence of industrial fisheries and the practice of reduction of fish is justified.

2.1 Justification for industrial fishing and reducing fish to meal and oil

i) Apparently, almost nobody in Europe wants to eat Norway pout or sandeels. Some sprat can be and are sold for human consumption but, at least historically, it has proved possible to land quantities of sprat far in excess of those required for human consumption. The stocks of these species are abundant and are capable of providing raw materials for a viable industry on which a number of other important industries depend either wholly or partially (aquaculture, various types of farming, synthetic foods etc.)

ii) One of the basic premises incorporated into the Common Fisheries Policy is that, subject to conservation needs, Member States have a historical right to pursue the types of fisheries which existed prior to the inception of the CFP. This premise includes industrial fishing.

iii) A second basic premise of the Common Fisheries Policy is that Member States may decide what to do with fish landed by their fishing vessels in their harbours. On this basis, there is nothing reprehensible in landing any species which, in principle, could be sold for human consumption, and using them as raw material for production of meal and oil, provided that the catches and landings are carried out within existing regulations.

iv) If species normally and predominantly landed for human consumption cannot be sold because of low quality or low market demand, it appears totally justifiable to convert them to meal and oil rather than dispose of them for no useful purpose.

v) Human consumption fishermen regularly discard large quantities of juvenile of the species which they traditionally exploit.

2.2. Criticisms of industrial fishing and industrial fish processing

i) Industrial fisheries remove from the sea large quantities of small fish species which are a major food source for other fish and for sea birds and mammals thereby putting at risk these populations.

ii) Industrial fisheries take a by-catch (usually juveniles) of those species of major importance for human consumption fisheries and therefore reduce the potential yield of the latter. Thus the use of small-mesh gears appears to go against the general strategy of increasing mesh sizes to protect juvenile fish.

iii) Monitoring of EC regulations applying to industrial fisheries is highly unsatisfactory, given in particular that very small meshsizes are allowed in derogation to the general principle of the protection of juvenile fish. Thus the Commission cannot guarantee to Member States fishing for direct human consumption that any data on catches by industrial fisheries accurately reflect either total landings or their species composition.

iv) Industrial fisheries and the reduction of fish to meal and oil is wasteful of scarce energetic resources especially when the meal/oil is used to support intensive aquaculture which is simultaneously accused of being economically inefficient and environmentally unsound.

3. ROLE OF THE COMMISSION IN RESOLVING THE INDUSTRIAL FISHERIES CONTROVERSY

3.1. Biological investigations

The Commission has initiated various investigations to assess the magnitude of the effects of industrial fishing on their target and by-catch species and to investigate the probable effects of changing the activities of industrial fisheries in various ways In addition, the Commission remains aware of the most recent biological assessments of the historical and current state of relevant stocks.

As a result, the Commission has been able, in some cases to define the magnitude of various problems and, where it appeared necessary, to initiate measures by which some movement towards the solution of at least some identified problems has been made.

3.1.1. Previous biological investigations

In 1979 the Commission stimulated the establishment of an ad-hoc Working Group of ICES to investigate the potential gains for human consumption fisheries for cod, haddock and whiting and losses for industrial fisheries which would be expected if industrial fishing were prohibited in a part of the North Sea. The results of this meeting were an important component in defining the conditions for establishing the so-called Norway pout box.

In 1989 the Commission produced a report to the Council (SEC(89)1931) on the sprat fisheries and their role in juvenile herring catches. Included in this report is an assessment of the expected gains to the spawning stock biomass and landings of North Sea herring following closure of the fisheries, nominally for sprat, in the Skaggerak and Kattegat and in the North Sea. On the basis of this report, the Commission has proposed reduced TAC's for sprat in the Skaggerak and Kattegat to alleviate the effects on North Sea herring of the so-called mixed clupeoid fishery in that area.

3.1.2. Recent biological evaluations

The biological evaluations referred to above are highly dependent on estimates of the rate at which fish die from causes other than fishing (the natural mortality rate). Since these previous evaluations were made, there has been a considerable revision of estimates of natural mortality rate thus the conclusions previously reached on gains and losses now need to be updated. Furthermore, it is now generally recognised by fisheries biologists that to assess the impact of industrial fisheries both on their target species and on the species taken as by-catch requires simultaneous consideration of "biological interactions" and "technical interactions".

The concept of biological interaction among the major commercially exploited species in the North Sea addresses the question "which species are eaten by each species". Each species may be a predator (as the whiting is for cod, haddock or saithe) of and/or prey for other species or itself (cannibalism).

The concept of technical interaction addresses the question "which species are caught by each fleet". Fleets compete with each other, at least to some extent, in exploiting the available fish stocks. Only when the stock(s) exploited by a specified fleet is not exploited by another fleet and when the specified fleet exploits no other stock(s) is there no technical interaction.

It is undoubted that predation of the major commercially exploited North Sea fish species also arises from other sources such as marine mammals, birds, and other fish species. In addition, all fish species, including those of major commercial importance, are subject to disease, parasitism, possible effects of ageing etc. At present (apart from some very preliminary work) it is not possible to quantify the effects of such factors on fish stocks throughout the whole of the North Sea and it is currently assumed by fisheries biologists that such effects remain constant from year to year.

In the light of the changes in the perception of fisheries biologists, the Commission has prepared a technical report (Assessment of the biological impact of industrial fisheries in the North Sea and in the Kaggerak and Kattegat) giving details of:

i) The current status of the major North Sea fish stocks affected by industrial fishing

ii) The probable effects of changing the fishing mortality rate (an indicator of the intensity of the fishery) of the North Sea industrial fisheries

iii) Recent investigations into the effects of nominal sprat fisheries on the North Sea herring stocks.

A copy of this technical report will be provided to all Permanent Representations. Alternatively, copies can be obtained on request from the Commission. The contents of the report are summarised in the sections 3.1.3, 3.1.4 and 3.1.5 of the present report.

3.1.3. Historical and current state of the North Sea fish stocks affected by industrial fishing and the current effects of industrial fishing on these stocks

a) Target species of industrial fisheries

Norway pout: Landings have varied between 100,000 and 200,000 tonnes since 1984. Fishing mortality rate (an indicator of the intensity of the fishery) has decreased since 1984 while spawning stock biomass (the total weight of fish in the

sea capable of reproduction) and recruitment (the number of young fish entering the stock each year) have varied without trend since the mid 1980's. At present it is estimated that fishing removes fewer fish from the stock each year than are removed by other causes of mortality.

Sandeel: Fisheries biologists regard the sandeel in the North Sea as two stocks.

Northern North Sea Sandeel: Landings increased from less than 100,000 tonnes in 1985 to between 400,000 and 500,000 tonnes subsequently. Fishing mortality rate has increased considerably since 1983 but spawning stock biomass and recruitment have varied without trend over the same time period. At present it is estimated that fishing removes more individuals from the stock than other causes.

Southern North Sea Sandeel: Landings have varied without trend since 1983, varying between 400,000 and 500,000 tonnes. Fishing mortality rate has also varied without trend. Spawning stock biomass increased greatly in 1987 when the abundant year class of 1985 reached maturity but otherwise has varied without trend as has recruitment.

Sprat: No assessments are available of the state of the sprat stock in the North Sea. Landings have decreased from 650,000 tonnes in 1975 to approximately 100,000 tones in recent years.

b) Species taken as by-catch in and/or otherwise affected by industrial fisheries.

Cod: Landings for human consumption have declined almost continuously from 1981 until 1991 when they reached the lowest level since 1983. Fishing mortality is considered too high and approximately 50% of the adult individuals are removed from the stock each year by fishing. Quantitative estimates of the rate of discarding are not available but anecdotal evidence indicates that discarding can be high in some components of the human consumption fishery. Similarly, there are no quantitative estimates of by-catches of cod in industrial fisheries but here it is believed that cod are not taken in large quantities as industrial by-catch. The fishing mortality rate is entirely attributable to the human consumption fisheries. Spawning stock biomass has declined since 1981 and is currently at or close to the lowest level on record. Concern has been expressed that the stock may not be able to replenish itself by recruitment. Recruitment is highly variable but has been low in recent years.

Haddock: Landings for human consumption in 1990 were the lowest since 1960. This is the result of the low stock size brought about by the low recruitment to the stock in recent years. Spawning stock biomass is also very low and concern exists about the stock being unable to replenish itself by recruitment. Fishing mortality is high. About 50% of the adult individuals are removed each year from the stock by the human consumption fishery. Some of these, and also juveniles which are also caught are discarded, dead, into the sea after capture. Current estimates indicates that discarding kills more (predominantly juvenile) fish than are taken as by-catch in the industrial fisheries.

Whiting: Landings of whiting for human consumption in 1990 reached their lowest recorded level since 1960. Large quantities of whiting have always been discarded by the human consumption fisheries. Prior to the 1980's industrial by-catch of whiting was an important and, in some years, predominant part of the total catch. In the mid and late 1980's industrial by-catch decreased but has increased again in recent years. The fishing mortality rate on whiting has been and currently is not as high as that on cod and haddock Spawning stock biomass has ben stable since 1982 and recent recruitment has been generally higher than average. At present it is

estimated that slightly more whiting are caught per year by industrial fisheries than are discarded by human consumption fisheries.

Saithe: There is a very small industrial by-catch of saithe but the fishery is predominated by vessels fishing for human consumption. Landings of saithe have declined from their highest recorded value of 320,000 tonnes in 1976 to 88,000 tonnes in 1990. Current spawning stock biomass is the lowest on record and recruitment has been low since 1984.

Herring: Landings were very low between the mid 1970's and early 1980's when various management measures were enacted in response to declining stock size and recruitment. Since then, landings have increased greatly to between 500,000 and 700,000 tonnes. Spawning stock biomass and recruitment were both low between the mid 1970's and early 1980's but both have recovered since then. Fishing mortality rate was high prior to the mid 1970's but has since been greatly reduced. Since 1981, fishing mortality rate has been about half that in evidence in the early 1970's.

The ICES Herring Assessment Working Group subdivides the total fishery for North Sea herring into five components.

(i) North sea small mesh fishery. This is an industrial fishery, nominally for sprat, which takes a by-catch of herring. The expected catch of North Sea herring in 1992 by this fishery is about 150,000 tonnes.

(ii) North sea other fishery. This is the fishery directed at herring for human consumption (although part of the landings may be used for industrial purposes depending on market conditions). The expected catch in 1992 is about 420,000 tonnes.

(iii) Mixed clupeoid fishery in ICES division IIIa (Skaggerak and Kattegat) This industrial fishery is also carried out nominally for sprats and takes a by-catch of herring of North Sea origin, herring from other areas and various other species. The expected catch of herring of North sea origin in 1992 is about 30,000 tonnes.

(iv) Directed fishery for herring for human consumption in ICES Division IIIa. Part of the catch is herring of North Sea origin, the rest is of local or Baltic origin. The expected catch of North Sea herring in 1992 is about 80,000 tonnes.

(v) Other landings for industrial purposes from Division IIIa. This component of the fishery is not further described by the ICES herring Assessment Working Group. The expected catch of North Sea herring in 1992 is about 120,000 tonnes.

Currently, the directed human consumption fishery for herring in the North Sea is the major cause of mortality of adult North Sea herring. The North Sea small mesh fishery is the next most important cause of fishing mortality but its effect is considerably less than that of the directed human consumption fishery except on juvenile herring (ages 0, 1 and 2). It is estimated that the small mesh fishery removes 3-7% of the juveniles and 2% of all older age-groups of herring from the North Sea each year. This may be compared to approximately 30% removal by the directed human consumption fishery of herring of age 2 and older.

The other components of the fishery, which operate in the Skaggerak and Kattegat, catch juvenile North Sea herring. At present it is estimated that between 1% and 6% of juvenile North Sea herring are removed each year as other industrial landings.

The mixed clupeoid fishery removes between 1% and 2% of the juveniles while the human consumption fisheries in Division IIIa remove a further 2% of the juveniles of North Sea herring. The fisheries which catch North Sea herring in Division IIIa do not catch adults of ages 3 and older.

3.1.4. The effects of changing the intensity of industrial fisheries

The probable effects of changing the intensity of industrial fisheries operating in the North Sea were investigated at a scientific meeting arranged by the Commission in the period 10-14 August 1992 in Aberdeen, Scotland. The effects were estimated using multispecies techniques incorporating the effects of both biological and technical interactions. Details of the simulations are given in the Commission technical document previously referred to.

a) Scenarios investigated

Six scenarios were investigated, according to the extent of the reduction (down to -40%) or increase (up to +40%) of fishing intensity applied to the industrial demersal fishery (i.e. the industrial fishery for Norway pout and sandeel), the industrial pelagic fishery (i.e. the industrial fishery for sprat), or both. Large enough changes in intensity for these industrial fisheries were simulated so as to produce noticeable effects either on the total, or on the spawning stock biomass or on both. However, the range of changes was restricted between -40% and +40% because simulating greater changes would have produced results outside the range historically observed for the stocks dealt with. This would have meant that some of the assumptions on which the simulations are based would have become invalid and that the predictions would become less trustworthy. The results of these simulations are presented in detail in the report on the "Assessment of biological impact of industrial fisheries" previously mentioned.

b) Changes in the industrial demersal fishery

In general, a reduction in the intensity of the industrial demersal fishery gives rise to increases in the yield from and the biomasses supporting the roundfish fishery. This is especially the case for whiting and, to a lesser degree for haddock. Benefits to cod are, however, minimal. Discards of whiting and haddock also increase because reduction in the industrial demersal fishery leaves more young of these species in the sea than would otherwise have been the case. A reduction in this fishery also leads to higher biomass of Norway pout and sandeel but at the expense of lower catches of these species. There is little effect on the fisheries and biomass of saithe, herring and sprat. Increasing the intensity of this fishery has the opposite effect to a reduction.

c) Changes in the pelagic industrial fishery

Reducing the intensity of the industrial pelagic fishery has a beneficial effect on catches of herring in the human consumption fishery. In addition, the biomasses of herring and sprat increase but at the cost of reduced landings of herring and sprat in the industrial pelagic fishery. The effects of reduction in this fishery on all the other species considered are negligible. An increase in intensity has the opposite effect to a decrease.

d) Changes in the total industrial fishery

The technical interactions between the fleets and the biological interactions between the species (as currently defined in the computer model) are such that a change in intensity in the total industrial fishery is almost exactly equivalent to summing the

effects of corresponding changes in each fishery as described in the two previous sections.

3.1.5. Effects of changes in the exploitation pattern for North Sea herring

The term "exploitation pattern" refers to the distribution of fishing intensity (i.e. the mortality due to fishing) between the various age groups of fish. It is reflected by what biologists call fishing mortality rates at age. Investigating the impact of changes in exploitation pattern in the fishery for North Sea herring implies, in particular, assessing the long-term effects of eliminating fishing mortality at low ages in various components of the fishery, thereby simulating the elimination of catches of juvenile herring.

This investigation was conducted by the ICES Herring Working Group during their meeting of March/April 1992. In this case, however, single-species rather than multispecies simulations methods were employed, thus the possible effects of biological interactions were not explicitly considered.

Seven scenarios were investigated which successively considered the elimination of catches of juvenile herring of various age groups, or that of the mixed clupeoid fishery in Division IIIa, in the whole of the North Sea or both. The results show that moderate gains in landings and appreciable gains in spawning stock biomass are expected if catches of juvenile herring can be eliminated in the North Sea or simultaneously in the North Sea and in the Skagerrak and Kattegat.

3.2 Conclusions from biological investigations

The above analyses demonstrate that reducing the fishing intensity or appropriately changing the exploitation pattern of the industrial pelagic fleet in the North Sea will result in appreciable gains in spawning stock biomass of herring and sprat and also in landings of herring for human consumption. Appropriate changes to the exploitation pattern of herring also lead to gains in biomass of that species. However, there is at present no indication that the spawning stock biomass of herring is at a level such that recruitment is likely to be adversely affected. Furthermore, the current state of the market for herring is such that increased landings may not be desirable. On the other hand, EC has agreed with Norway that the management objective for North Sea herring should be to achieve a spawning stock biomass of 2.2 million tonnes. Changes in the industrial fisheries would assist in achieving this objective but it is likely that changes in other fisheries would also be required.

Similarly, reduction in the intensity of the industrial demersal fishery leads to appreciable gains in the biomass of Norway pout and sandeel. Again, the biological requirement for this is not apparent at present. Appreciable gains are probable in the landings of whiting, moderate gains are likely for haddock and minimal gains are likely for cod and saithe. The spawning stock biomass of whiting increases but the requirement for this is not evident at present. Increases in the spawning stock biomass of haddock, cod and saithe are, at present, highly desirable but probable gains from reducing the industrial demersal fishery are at best moderate (for haddock) or small (cod and saithe).

In summary, and on a purely biological basis, it appears that some gains could be made for some stocks and fisheries by modifying the activities of industrial fisheries. However, and again on a purely biological basis, the necessity for these changes appears at present not to be compelling.

3.3. Regulations on industrial fisheries

3.3.1. Current regulations

To deal with the by-catch problem of industrial fisheries and to control the portion of the stocks that may be removed each year by industrial fisheries, the European Community has adopted a number of rulings which include a ban on the directed industrial fisheries for herring and on on-board processing operations, restrictions on fishing areas, meshsizes, and percentages of by-catches, and TACs for Norway pout and sprat in the North Sea. A brief description of and references to these regulations are given in Appendix I. It should also be remembered that various licensing schemes and rules for enforcement or reporting, which apply only to their nationals, have also been adopted by individual Member States.

3.3.2. Arguments for further regulations

As pointed out in the Commission report on monitoring implementation of the Common Fisheries Policy (SEC(92)394) technical measures relevant to industrial fishing are notably difficult to implement. Firstly, there are problems for inspectors to obtain reliable estimates of the species composition of catches by industrial fishing vessels. Secondly, given the year to year and longer term variations in the relative stock size of target species and potential by-catch species it is difficult for industrial fishermen to ensure that they take catches of a predefined species composition.

At present, therefore, the Commission finds itself in a position where it cannot guarantee to Member States that the monitoring and control of industrial fisheries is always in accordance with existing regulations. For example, it is hard to maintain that percentage by-catch regulations are being observed in the North Sea sprat fishery when scientific evaluations indicate that about 150,000 tonnes of herring will be landed in 1992 by this fishery.

These considerations explain why it is so widely believed by those who fish for human consumption that the regulations dealing with industrial fisheries are poorly enforced. Conversely, they also explain the point of view of industrial fishermen that, despite their best intentions, it is extremely difficult for them to pursue their activities within existing regulations.

Furthermore, suspicion that monitoring and control of industrial fisheries is deficient gives rise to doubt about the validity of the existing biological assessments and any potential socio-economic assessment. On this basis, the apparent case given in section 3.2 of this report that the biological necessity for changing the activities of industrial fisheries is not compelling is held to be incorrect in many quarters. In this context, it is the case that data on landings by industrial fisheries of the type required to carry out biological investigations have been of poor quality in recent years.

4. GENERAL CONCLUSIONS

At present, the only synoptic view of industrial fisheries is that provided by fisheries biologists. No similarly synoptic perception is available of the probable socio-economic effects of further regulations. Unless or until a more complete evaluation becomes available the principal aim must be to ensure effective enforcement of existing regulations.

In addition to ensuring effective monitoring and control, some longer term actions should be considered leading to generally improved resource management. Biological evidence available at present does not justify the complete closure of industrial fisheries in the North Sea and Skaggerak and Kattegat. However, this evidence indicates that industrial fisheries have an impact on those species on which the major human consumption fisheries depend.

However, many of the management measures for industrial and other fisheries either implemented or proposed to improve the state of North Sea fish stocks were constructed some years ago on the basis of single-species calculations which ignore the effects of biological interactions. Among these suggestions are reduction in fishing mortality (essentially a reduction in the time spent fishing) on roundfish, flatfish and industrial species, areal and temporal restrictions on the activities of fishing vessels and improvement in the selectivity of fishing gears, particularly those used in fisheries for roundfish and flatfish.

The time has come to review these proposals in a multispecies context. The results of implementation of all of the above proposals either simultaneously or in various combinations may be different to the simple addition of the results of adopting such measures in isolation.

In addition, and in parallel to the biological investigations, a socio-economic evaluation of the probable effects of the implementation of any proposal is urgently required. In this context it should be noted that a project to report on the Danish fishmeal industry is about to be initiated.

Until such information is available to the Commission and Member States future proposals for and implementation of regulations with respect to industrial fishing will remain a piecemeal process. If such information can be made available it is likely that a strategy can be evolved which will incorporate not only changes to industrial fisheries but also changes in other fisheries.

APPENDIX I: EC CURRENT RESTRICTIONS ON INDUSTRIAL FISHERIES

The European Community has implemented a number of rules and regulations aiming at the protection of the juveniles of by-catch species industrial fisheries. Some of these regulations also are meant to deal with the control of the portion of the stocks that may be removed each year by industrial fisheries. These rulings include technical restrictions either on meshsizes or on fishing areas, and TACs for the target stocks of industrial fisheries in the North Sea and in the Skagerrak and Kattegat.

- a ban on the directed industrial fisheries for herring in EC waters and on the landing anywhere in the EC of herring caught for this purpose (R(EEC) 2115/77)
- a 10% by-catch limit for the main human consumption species applied to all small-mesh species (R(EEC) 3094/86)
- a 15% by-catch limit of which not more than 5% can be constituted of cod and haddock for the Norway pout fishery (Article 14 of R(EEC) 3882/91)
- a ban on on-board processing operations (Article 10a of R(EEC) 3094/86) to facilitate the control of by-catch levels
- a prohibition on fishing for Norway pout with small-mesh (16 mm) nets in a particular area of the North Sea, called the "Norway pout box", off the east coast of England (Annexe I of R(EEC) 3094/86)
- TACs for the mixed clupeoid fishery in the Skagerrak and for Norway pout in Area IV (North Sea) and for sprat, blue whiting and horse mackerel in various parts of Areas IV, VI and VII

Furthermore one should mention the various restrictions on fishing areas which apply to all fishing activities including industrial ones, within the North Sea such as the Herring Box off the East coast of England implemented by Article 6 of R(EEC) 3882/91) or the Sprat Box implemented by Article 8 of R(EEC) 3094/86 inserted by R(EEC) 345/92. Finally, one should add to the previous EC regulations the various regulations, licensing schemes and rules for enforcement and reporting adopted by individual Member States which apply only to the nationals from these Member States.