



**COUNCIL OF  
THE EUROPEAN UNION**

**Brussels, 11 October 2001**

**12719/01**

**LIMITE**

**PECHE 197**

**COVER NOTE**

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from : Danish Permanent Representation  
date of receipt : 10 October 2001  
to : General Secretary of the Council  
Subject : Note on the industrial fisheries in Denmark

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We kindly ask the Council Secretariat to distribute the enclosed note on the industrial fisheries in Denmark.

(Complimentary close).

(s.) Kenn SKAU FOGTMANN  
Food Attaché

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Ministry of Food, Agriculture and Fisheries

Copenhagen

27 September 2001

### **Fishery for Industrial Species**

The fishery for industrial species has lately been the target for substantial criticism from a wide range of players. The criticism has increased with the current debate on the revision of the common fisheries policy and the on-going work with the recovery plans for cod and hake.

Denmark has a long tradition for fishery for industrial species and today the fishery plays an important role for the Danish industry. In that respect, it should be mentioned that the final products coming from this fishery – oils and meals – both form a very important component in the aquaculture business, a sector which is growing rapidly in numerous countries.

The fishery as such is carried out with due respect to the scientific advice and the fishery is generally considered to be environmentally sustainable. It can be added, that fishery for industrial species is among the most monitored, controlled and scientifically best studied fisheries.

From a Danish point of view it is the belief that this paper on fishery for industrial species can eliminate some of the misunderstandings that exist around today's debate and at the same time contribute to an open and unbiased dialogue about the future for this particular type of fishery within the future common fisheries policy.

Ministry of Food, Agriculture and Fisheries

Denmark

September 2001

Facts  
on  
the Industrial Fisheries

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## 1. Introduction

Those involved in the industrial fishery often find the knowledge of this sector so limited that it is difficult to have a constructive dialogue with those outside the sector.

This report gives a short description of the Danish industrial fisheries (Chap.2), a description of the actual processing of the industrial species including the use of the products (Chap. 3), an introduction to the biological aspects (Chap. 4), and the management and control of industrial fisheries at national level (Chap. 5).

It is hoped that this report will contribute to overall knowledge of the sector.

## 2. Description of the industrial fishery

Denmark has had an important industrial fishery since the beginning of the 1950's. It was originally based on herring. Today the industrial fishery is basically targeting sand eel (which is the most important species), sprat, Norway pout, blue whiting and horse mackerel. The landings of sand eel, sprat and Norway pout make up for more than 90 % of the total landings in the industrial fishery. These species have no commercial value as human consumption.

The fleet involved fully or partly in industrial fishery comprises more than 300 vessels and involves around 1,000 persons on board the boats.

The fishery regulations have been made very rigorous over the years. Minimum percentages of target species have been introduced as well as maximum percentages of human consumption species and there is now a quota for by-catches of herring.

In addition to the regulations, catch composition is also influenced by e.g. the size of incoming year classes for the different fish stocks. The catch composition of the landings for the most important industrial fisheries is shown in table 1 (the North Sea) and table 2 (the Skagerrak and the Kattegat).

*1000 tonnes	Industrial fisheries for Norway pout		Industrial fisheries for sandeel		Industrial fisheries for sprat		Industrial fisheries for "Others"		Landings (Total)	
	1996-99	2000	1996-99	2000	1996-99	2000	1996-99	2000	1996-99	2000
Norway pout	59.2	126.2	2.1	0.6	0.6	0.1	0.4	0.0	62.3	127.0
Sandeel	1.3	0.0	611.9	540.5	3.4	0.4	1.0	0.0	617.6	541.0
Sprat	0.2	0.0	4.9	2.4	113.2	188.5	0.7	0.3	119.1	191.2
Bluewh.w	35.5	33.1	1.4	0.7	0.1	0.0	0.3	0.0	37.3	33.9
Horsemackerel	0.7	0.0	0.4	0.3	0.3	3.2	1.0	0.9	2.4	4.4
Herring	1.9	4.0	4.8	2.1	13.2	11.7	0.2	0.0	20.0	17.8
Cod	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.4	0.1
Haddock	1.2	2.0	0.7	1.2	0.0	0.1	0.0	0.0	1.9	3.3
Whiting	1.2	3.1	1.8	1.5	0.7	2.1	0.0	0.0	3.7	6.7
Mackerel	0.6	0.3	0.5	0.4	0.2	0.8	0.1	0.1	1.4	1.5
Saithe	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Other specie.	5.3	2.1	2.0	1.2	0.4	1.8	3.0	4.2	10.8	9.3
Total	107.5	171.1	630.8	551.0	132.1	208.6	6.8	5.6	877.2	936.4

Table 1. Average landings from the North Sea by different Danish industrial fisheries in the period 1996-1999, and 2000. The composition of the landings is estimated from monitoring samples. The classification of the fisheries below is based on the target-species being at least 50% of the landings within a month and within a given statistical rectangle. Source: Danish Institute for Fisheries Research (DIFRES).

Table 2. Average landings from the Division IIIa (Skagerrak and Kattegat) by different Danish industrial fisheries in the period 1996-1999, and 2000. The composition of the landings is estimated from monitoring samples. The classification of the fisheries below is based on the target-species being at least 50% of the landings within a month and within a given statistical rectangle.  
Source: DIFRES.

*1000 tonnes	Industrial fisheries for Norway pout		Industrial fisheries for sandeel		Industrial fisheries for sprat		Industrial fisheries for "Others"		Landings (Total)	
	1996-99	2000	1996-99	2000	1996-99	2000	1996-99	2000	1996-99	2000
Norway pout	13.3	5.9	3.5	1.1	2.5	1.6	3.3	0.9	22.5	9.6
Sandeel	2.5	0.7	32.3	15.8	0.9	0.0	3.6	0.1	39.3	16.6
Sprat	0.7	0.0	0.2	0.0	10.6	12.6	1.1	0.1	12.6	12.7
Bluewh.	5.3	2.0	0.8	0.4	0.3	1.6	1.1	0.3	7.4	4.2
Horse mackerel	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.3	0.0
Herring	1.6	0.5	0.6	0.2	7.5	8.0	1.8	0.2	11.7	8.9
Cod	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.4	0.1
Haddock	0.5	0.3	0.2	0.1	0.2	0.3	0.2	0.0	1.1	0.8
Whiting	0.2	0.0	0.1	0.0	1.0	1.1	0.1	0.0	1.4	1.2
Mackerel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Saithe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Other spec.	1.3	0.5	0.4	0.1	0.8	0.3	1.9	2.9	4.4	3.8
Total	25.5	9.8	38.3	17.8	23.9	25.6	13.5	4.8	101.2	58.0

Tables 1 and 2 show average landings for each species in the period 1996 - 1999 and landings for 2000. As can be seen, by-catches in the sand eel fishery are very small. The by-catch of herring decreased significantly in 1997 as a result of the monitoring system established in 1996 and is now at a very low level

The estimated catches of target species and by-catch species are shown in table 3.

	North Sea		Skagerrak		Kattegat		Total
<b>Target-species</b>							
Sandeel	500,105	63.3	11,081	30.4	569	3.0	511,755
Sprat	162,713	20.6	6,812	18.7	10,438	54.9	179,963
Norway	40,969	5.2	6,822	18.7	675	3.6	48,466
Bluewhiting	41,117	5.2	3,623	9.9	273	1.4	45,013
Horse mackerel	4,432	0.6	73	0.2	78	0.4	4,583
<b>By-catch species</b>							
Herring	15,232	1.9	3,211	8.8	5,867	30.9	24,310
Cod	101	0.0	60	0.2	52	0.3	213
Haddock	1,056	0.1	334	0.9	90	0.5	1,480
Whiting	3,826	0.5	503	1.4	694	3.7	5,023
Mackerel	1,196	0.2	81	0.2	0	0.0	1,277
Saithe	40	0.0	37	0.1	0	0.0	77
Grey gurnards	2,396	0.3	100	0.3	5	0.0	2,501
Others	16,985	2.1	3,689	10.1	271	1.4	20,945
Total	790,168	100.0	36,426	100.0	19,012	100.0	845,606

Table 3: Estimated catches from the industrial fisheries in the North Sea, the Skagerrak and the Kattegat 1999. Estimated from test samples. (Tonnes/percent).  
Source: DIFRES.

The sand eel fishery is the dominant industrial fishery in the North Sea. In 1999 sand eel, sprat, Norway pout, blue whiting and horse mackerel accounted for 94.8% of the catch. In 2000 the catch of these species was 95.8% of the total catch.

### 3. The processing of industrial fish

Industrial fish goes through a production process which, simplified, consist of boiling, separation and drying. 100 kilos of industrial fish can produce approx. 20 kilos of fishmeal and 2-10 kilos of fish oil.

Fish oil is used for the production of margarine and is a vital ingredient in fodder for aquaculture. Small amounts are also used within the medical, paint and lacquer industries. In the production of margarine fish oil, competes openly with other oil products such as soya bean, rape-seed and palm oils. In the production of aquaculture fodder there is currently no alternative to fish oil.

Fishmeal has several nutritional qualities, which makes it attractive as a protein supplement in fodder for animal husbandry e.g. poultry, piglets, cattle, sheep, furred animals and fish. Fishmeal as a protein supplement competes openly with other protein sources such as skimmed milk powder, soya bean meal, rape-seed meal etc. In recent years the aquaculture industry has bought increasing amounts of fishmeal.

The Danish fishmeal and fish oil industry consists of 3 independent companies with 4 factories located in Esbjerg, Thyborøn, Hanstholm and Skagen. Apart from the factory in Hanstholm the remainder are co-operative companies owned by the fishermen. The fishermen and their co-operative have mutual obligations with respect to supplying and receiving fish.

In addition to the industrial fish landings, fish offal from the human consumption industry is used in the fishmeal and fish oil production. In 2000 the companies within the Danish Association of Manufacturers of Fishmeal and Fish oil processed 1.48 million tonnes of raw material of which the main part was industrial fish and the rest offal from the human consumption industry. 311,000 tonnes of fishmeal and 100,800 tonnes of fish oil were produced from this amount of raw material.

The number of employees varies throughout the year, but there are usually 500 - 600 employees within the 3 companies. The highest number occurs in the peak season during the summer, the lowest during winter.

The industrial fisheries sector contributes positively to the Danish balance of trade. In 1999 exports of fishmeal, fish oil and non-processed industrial fish came to approx. 1.6 billion DKK (approx. 215 million EUROS). Imports were approx. 700 million DKK (approx. 94 million EUROS).

Of the total export value of the fisheries sector, the industrial fisheries accounts for approx. 10%, of which almost half is exported to countries within the EU.

The regional economic significance of the industrial fisheries is of great importance to the counties located in the west and north of Jutland where the Danish fishmeal industry is concentrated. Most industrial fishing vessels are registered in the ports in these counties.

## 4. Biological issues

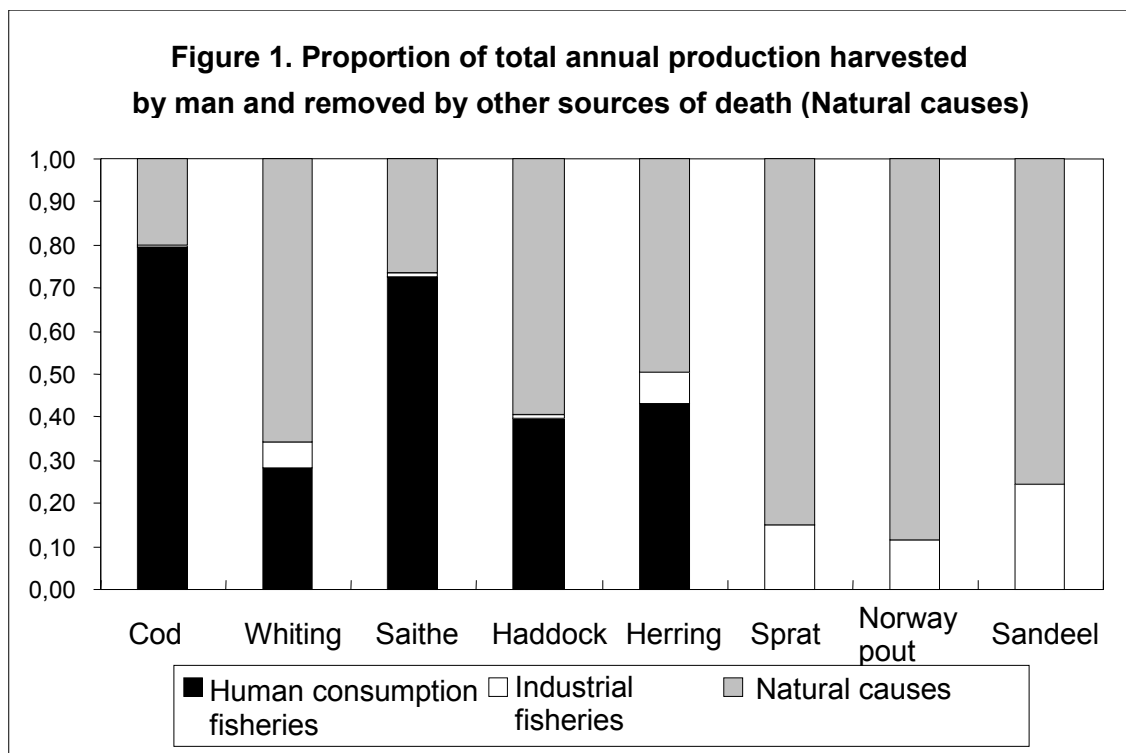
### 4.1. Biological effects of the industrial fisheries

The most discussed consequences of industrial fisheries are the by-catches of species mainly fished for human consumption, and the removal of prey species biomass from the food-chain. The by-catch issue is related to a possible reduction of the potential yield within the human consumption fisheries. The catch of the target species raises the question whether the removal causes food deprivation for predators such as larger fish, seabirds and marine mammals, or whether the removal may cause other changes within the ecosystem.

When assessing both the direct and the indirect effects of the industrial fisheries it is clear that the position of the species within the ecosystem plays a role. Most of the industrial fisheries target species which feed on plankton and other invertebrates and are themselves food for predatory fish, seabirds and marine mammals. The industrial species are thus characterised by being prey for a number of (top) predators in the food-chain. If the fishery on the industrial species becomes too intensive it may remove the food resources for predators and change the energy flow in the food-chain.

Figure 1 shows the proportional removal of the annual production for several human consumption species and industrial species by industrial fisheries, human consumption fisheries and natural removals. It can be noted that the industrial fisheries harvest less than 25% of the annual production of the industrial species sandeel, sprat and Norway pout leaving more than 75% of the annual production for human consumption species, birds and marine mammals. No research from the North Sea has shown changes in fish growth due to changes in food availability. Nor are there indications that the current industrial fisheries have caused food deprivations for fish in the North Sea. The removal of the high quantity of industrial species and human consumption species as well affect the ecosystem. Quantification of these effects is however not simple and the exercise should at least include the effect of fishing on both industrial and human consumption species.

The human consumption fisheries harvest a significantly larger share of annual production of the human consumption species. For cod approx. 80% of the annual production is harvested.



#### 4.1.1. Target species

The most important target species for the industrial fisheries are sand eel, Norway pout, sprat, capelin, horse mackerel and blue whiting. ICES assesses the stock situation for the most important industrial species each year.

Fishing mortality is generally moderate or low for the industrial species. Sand eel and Norway pout are considered within biological safe limits (above  $B_{pa}$ ). ICES is not able to make analytical assessment of the sprat in the North Sea, the Skagerrak and the Kattegat, but abundance index from scientific surveys indicate a relatively large biomass. Sprat in the Baltic Sea is within biological safe limits.

#### 4.1.2. By-catch species

Several species are caught as by-catch in the industrial fisheries. Human consumption species above the minimum landing size are normally sorted out and landed for human consumption, while undersized fish are landed for reduction. The by-catches of fish for reduction are relatively small in terms of weight and have decreased in recent years (table 3). Their importance for the potential yield and stock development is negligible for most species.

### **4.1.3. Physical impact of the sea**

The industrial fishery is generally operated with pelagic trawl or bottom trawl. The pelagic industrial trawl fisheries target sprat, capelin, and blue whiting. The pelagic trawls rarely touch the sea bottom and therefore do not directly affect the bottom fauna and flora. The industrial fisheries with bottom trawls do have a mechanical effect on the sea bottom, but the effect must be considered as a light disturbance. Little is known about the effects of bottom trawls on bottom fauna and flora, but it is assumed that there are no problems specifically related to the industrial fisheries.

## **5. Management and control of the industrial fisheries at national level**

### **5.1. Management of quota utilization**

The management of the industrial fisheries is primarily based on a seasonal division of quotas e.g. a share of a given quota is set for one quarter of the year. This division of quotas over the year is combined with rations over limited periods. The rations are divided and given to the individual vessels by a vessel length based system, usually as permission to land a given amount of fish within a set period.

The management rules include the possibility of closing certain areas that are considered critical with regard to by-catches.

Temporary stops are used as part of the management of some sprat fisheries. This instrument is used for limiting the by-catches in periods with a high probability of herring by-catches.

### **5.2. Control of vessels**

A basic license is required to take part in all industrial fisheries. Special licenses are also needed to take part in the industrial fisheries outside the North Sea, Skagerrak and Kattegat, and for the sprat fisheries in Skagerrak, Kattegat and the Baltic Sea.

The industrial fishing vessels have to keep a log-book in the same way as all other fishing vessels.

The control rules require that industrial fishing vessels notify the authorities before changing to other fishing zones (e.g. from the North Sea to the Skagerrak) as well as before arrival and landing of catches.

Random samples are taken from the landings to check that rules on target species and by-catches are observed and to estimate the species distribution of the industrial catches (See 4.3)

The Danish Directorate for Fisheries targets its control efforts towards those fisheries that are considered important to monitor at a given time.

### 5.3. The registration and monitoring system

In order to carry out an industrial fishery member states must have a registration and monitoring system. The system must be able to analyse the species composition of the industrial catches.

The Danish monitoring system is based on a computerised random selection of vessels to be inspected, and a model for estimating the herring by-catches, both managed by the Danish Directorate for Fisheries in co-operation with DIFRES.

The Danish registration and monitoring system has three objectives:

- Determination of the species composition from industrial catches. This is used for biological assessments (ICES).
- Continuous monitoring of the quota and surveillance of the industrial fisheries.
- Managing the herring by-catch limits.

The objective of the monitoring system is to have at least one sample for every 1,000 t landed. In 2000 1,625 samples from landings of Danish fishing vessels were taken corresponding to one sample for each 619 tons landed. Each test sample weighs about 10 kg but will be larger if violations are detected, e.g. 0.5 % of the total landed quantity with a maximum of at least 100 kg.

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