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FLEXIBILITY IN THE NORTH NORWEGIAN FISHING COMMONS

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Abstract

Flexibility in the fishing commons is one way the fishermen can adapt to changes in the marine ecological systems. If we regard the marine systems as "systems of chaos", the fishermen's flexibility in adapting is a way of coping with the uncertainty and costs associated with the unpredictable variation in the biomass of the individual species within the systems. From this point of view, the fishery management has been criticized for basing the regulations on single-species fishing and not taking into account the more flexible types of fishing (multi-species fishing).

The paper presents an empirical study of flexibility in the North Norwegian fishing commons. Flexibility is defined as fishery characterized by the exploitation of different species, and that the exploitation is evenly distributed among the species. The analysis is based on statistics for 1993 from the Norwegian Directorate of fisheries, and include data on the catch of 1277 fishing boats registered in the county of Finnmark.

The main findings are that the mobile ocean and coastal fishing boats, which use active fishing gear like seines and trawls, are the most flexible fleet. In contrast, the less mobile fishing boats that fish in the fjords, and use passive fishing gear - especially handlines, comprise the least flexible fleet. The findings show that modern fisheries are not characterized by poor technology which means that the non-mobile fishing boats have to exploit the fish species that crop up in the local area. Instead, flexibility is associated with the largest, most mobile and best equipped fishing boats. Thus mobility is not a way of achieving selective or single-species fishing. The author also argues for a more precise definition of flexibility, because while the mobile boats with active gear are functionally flexible, the less mobile fleet using passive gear is numerically flexible.

Therefore a sustainable and flexible - or multi-species management of the fisheries - has to be adapted to numerical flexibility in the modern fisheries. This management could then build on the traditional knowledge of the small-scale fishermen about how to regulate the local biomass of the stock, or on the social norms in local fishery communities that regulate the exploitation. A type of management that promotes functionally flexible

fisheries will favour the capital-intensive mobile fleet.

Introduction

Flexibility is the ability and potential to obtain and utilize production equipment and competence in several different ways. The flexibility exercised by the fishery industry in the fishing commons can be studied from two professional perspectives. The first is the perspective of employment and economic life, where flexibility is a means of achieving a competitive advantage. Enterprises choose flexible strategies rather than specialization strategies because rapid technological development, new products and new markets make it necessary have the ability to adapt quickly to changing situations. The second is the perspective of the ecological system, where flexibility is a way for fishermen to adapt to an ecological system characterized by strong fluctuations. The fishermen choose flexible strategies to enable them to deal with uncertainty connected their possibility of predicting conditions within the system.

Critics maintain that both the public industrial policy and the regulation policy are adapted to actors who choose specialization. The purpose of this paper is to study flexibility in the North Norwegian fisheries, and discuss the possible implications of the observed pattern of exploitation for regulation of the fishing commons.

Flexible strategies for employment and economic life

Many persons have regarded flexible strategies for organization of markets and work as the "solution" to the major socio-economic changes experienced in the industrial world during the last decade. The specialized fordist strategies of mass production have been replaced by strategies that can be expressed by such terms as "flexible specialization" (Piore & Sabel 1984) and "flexible enterprises" (Atkinson 1984 & 1985). The first concept has dominated the debate on employment and economic life in Norway, the other has been important in Britain (Lie 1994). Usually the studies focus on descriptions of flexible strategies introduced at enterprise level, where small and medium-sized enterprises, because they are more flexible, have a competitive advantage over larger enterprises. The "new" enterprises are characterized by the use of functional and numerical strategies (Lie 1994:284); combinations of these have been shown to be

particularly effective. By applying this perspective to the fishing industry in Norway, I postulate that also the actors within this industry are "modern", that is to say, they choose their fishing strategies on the basis of competitive ability or a demand for interest on invested capital. This contrasts with the picture of the "traditional" fishing industry where, owing to lack of technology, flexibility meant adapting to fluctuations in the ecological system by fishing the species present at the time. Further, I consider it important to describe the flexibility in today's fishing industry by means of terms that have been developed as part of the research on employment and economic life, because the debate on the management of the fishing industry has not taken into account the kind of flexibility that characterizes this industry today.

In the research on employment economic life, numerical flexibility is defined by a situation where the number employed in an enterprise varies, often seasonally, and that the work force is connected to the enterprise in different ways (e.g. different systems of working hours). Functional flexibility implies that the enterprise has a core group of employees with a broad range of qualifications, who can carry out several types of work. A condition is that the technology used by the enterprise is so-called "multipurpose technology" (Brusco 1986), which makes this type of flexibility feasible. So-called "footloose" enterprises move out of the country in order to obtain cheaper labour, to come closer to markets, and to achieve numerical flexibility. Probably it is easier to arrange less stringent employment contracts with weakly organized workers in recently industrialized countries than with well-organized workers in Scandinavia.

Flexible adjustments to the marine ecological system

If we move from the organization of the market and the work to the natural resources aspect of the operations, flexibility becomes another way of dealing with an ecosystem marked by large fluctuations. Flexible fishing becomes an alternative to specialized or selective fishing. In one context, flexible strategies become a means of dealing with the costs connected with specialized fishing (Wilson 1982 & 1990), where the costs of finding the stocks of a specific species of fish are especially high. It is also assumed that flexible strategies require a different kind of basic knowledge about the marine system than specialization strategies do. The latter are based on a scientific way of thinking, involving

an attempt to establish a predictable ecosystem by trying to control the relationship between the size of the spawning stocks, recruitment to the population and taxation of the stock of the population (Wilson, French, McKay & Townsend 1991, Wilson, Acheson, Metcalfe & Kleban 1994).

In the debate on flexible regulation, it is stated that the reason why the fishermen choose flexible strategies is that they have been socialized into another paradigm of knowledge about the marine system than that of the scientists. This paradigm is often called "the chaos paradigm", and has the following characteristics (Wilson & Kleban 1992):

- a) The biomass of an ecological system is relatively stable.
- b) The biomass of the different species within the system varies considerably, and in a way that makes it difficult to predict the state of the different species within the system.
- c) The system shows a capacity for compensation, that is to say, when the stock of one species increases the stock of another declines.
- d) There is no specific relationship between the size of the spawning stock and recruitment of fish to the stock that is exploited several years after the spawning.

If the marine ecological system possesses these "chaotic" features, flexibility in the meaning of taxing several species within a single system becomes a strategy that reduces the costs associated with the impossibility of being able to predict the state of each species within the system. This is the reason for criticizing the management regime for lack of flexibility. In modern society, the management of fishing is based on the standard paradigm of knowledge (Smith 1990), where the objective is to predict the future size of the stocks of the different species. In order to regulate the catch of each species, the management is based on restrictions on the access to participate in the fishing, and on fixing annual quotas for each of the stocks. Management based on a chaos paradigm would instead emphasize rules for use of gear, and would close certain fishing fields for specific periods.

Hypotheses concerning flexibility in the fishing commons

Fishing based on exploiting many species is a functionally flexible strategy. Fishing based

on exploiting few species is specialized fishing. This paper focuses on analyzing functional flexibility in the exploitation of the North Norwegian fishing commons, partly because, in my opinion, much of the criticism of the management regime has been that it is not sufficiently adapted to a type of fishing that switches in an unpredictable way between species. This could mean that the management regime lacks sustainability, because the ordinary methods of management do not, to a sufficient degree, stop the fishing of declining stocks in order to direct the fishing effort to stocks that are growing. James A. Wilson describes the role of the fishery management as follows:

"... it is appropriate for management to reinforce those factors that influence the decision to direct fishing effort away from declining populations and towards ones of greater abundance. It also suggests that single species management that effectively prohibits switching may build a tendency to fish populations to a lower level than would be experienced in multiple species fishery" (Wilson 1990:27).

Research has identified in particular this kind of limiting factor in local regulation regimes based on local knowledge and local norms for how the fishing should be carried out. These social characteristics of fishery communities have been identified in smaller local communities, and the fishing in local areas (fjord fishing) is regulated in this way (Eythorsson 1991). Thus, if flexible fishing is to be sustainable, we expect to find this sustainability primarily in connection with small-scale fishing. The large coastal and ocean fishing fleets, on the other hand, can carry out specialized fishing because they are geographically flexible.

Method

The analysis is based on two sets of data. Firstly a "delivery note register" for 1993 from the Norwegian Directorate of Fisheries. Every time a fisherman sells fish to a buyer, he has to fill in a final delivery note. This contains information on what kinds of species

have been delivered, the amount of each species delivered, in what county and municipality the vessel is registered, what gear was used, where the fish were caught and where the catch was delivered. Our analysis covers the catches of vessels registered in Finnmark, the northernmost county in Norway. The analysis includes data from 1277 vessels, altogether 157 963 thousand tonnes round weight. The statistics refer to 62 fish species. The Finnmark fleet caught 29 of these species in 1993. The statistical analysis of this material was supplemented by interviews with fishermen from some fishing communities in Finnmark. These data were used to shed light on certain finds in the statistical analysis.

Results

The species exploited was given for 99.9 per cent of the total quantity of fish caught, i.e. 157 792 tonnes round weight. This catch was distributed between 29 species. 33 per cent of the total quantity consisted of cod and spawning cod, while 51 per cent consisted of cod species (cod, saithe and haddock). Only catches of cod, saithe and capelin accounted for more than 10 per cent of the total catch.

61 per cent of the catch was fished outside the 12 mile limit. This is defined as ocean fishing. Coastal fishing within the 12 mile limit accounted for 39 per cent. The ocean fishing included 27 species, with a standardized modal per cent¹ equal to 30. The coastal fishing included 19 species, and the standardized modal per cent in this case was 50. This indicates that the ocean fishing fleet possesses the greatest degree of functional flexibility. These figures show that our original hypotheses do not hold good.

¹ The formula for the standardized modal per cent is as follows: $(\text{Modal per cent} - 100 / \text{number of values of the variable}) : (100 - 100 / \text{number of values}) \times 100$. This value can be used to compare the distribution of the values of the variable at nominal level that have different numbers of values. The modal per cent ranges from 100 to zero, where the distribution is more even the lower the values are.

A further analysis showed that choice of gear was the most decisive factor for whether the pattern of exploitation was functional or not.

Coastal fishing with passive gear is very specialized, i.e. mainly specialized cod fishing. The other types of fishing are fairly equally distributed between the species. Ocean fishermen using active gear tax most species, while coastal fishermen using active gear do not exploit more species than exploited by coastal fishermen using passive gear. However, the passive gear promotes much more selective fishing.

Table 1 Standardized modal per cent for ocean and coastal fishing by active and passive gear² (number of species exploited in brackets)

	Ocean fishing	Coastal fishing
Active gear	36 (25)	32 (12)
Passive gear	46 (12)	70 (11)

We tried to identify mobile and non-mobile fleets by analyzing where the fleets from different municipalities delivered their catch. In the municipalities with the most mobile fleets, more than 80 per cent of the catch was delivered in a municipality other than the one in which the boat was registered, or a neighbouring municipalities. The fleets from these same municipalities delivered more than 70 per cent of their catch outside the county of Finnmark. All these municipalities had facilities for receiving the catch. In the municipality with the least mobile fleet, only four per cent of the catch was delivered outside the boats' own municipality or a neighbouring municipality. In two other municipalities these percentages were 26 and 28 respectively. In these three

² Active gear consists of seines, Danish seines, prawn trawls and other trawls. Passive gear consists of nets, handlines and other lines.

municipalities, only respectively two, five and 12 per cent of the catch was delivered outside the county. In the three municipalities with the most mobile fleet, the average number of species exploited was 15, with a standardized modal per cent of 33. In the four municipalities with the least mobile fleets, the fleet exploited on average 10 species, with a standardized modal per cent of 56. This again shows that the most mobile fleets are the most functionally flexible.

A more in-depth analysis was undertaken by grouping the fleets in the seven municipalities according to whether they are mobile or not, and whether the fleet carries out coastal/ocean fishing or small-scale fishing in the fjords.

The fleet carrying out the clearly most specialized, or selective, fishing is thus the non-mobile fjord fishing fleet. Most functionally flexible, on the other hand, are the mobile coastal/ocean fishing fleets or the purely coastal fishing fleets.

Thus the analysis gives a result that is completely opposite to what was expected. In the final part of the paper I shall discuss the reasons for this, its implications for the content of the term flexibility of the fishing, and the consequences for the regulation of the modern fisheries.

Table 2 Standardized modal per cent showing distribution between the special exploited in seven municipalities with different types of fleets. (Showing in brackets the number of species that are exploited by the fleets in the municipalities).

Municipalities characterized by:

Fleet carries out:	Mobile fleets	Non-mobile fleets
Coastal/ocean fishing	36 (18)	45 (15)
Coastal fishing	30 (9)	None in sample
Fjord fishing	Irrelevant	68 (6)

Conclusions

The different types of fishing fleet showed differences as regards their ability and possibility of exercising functional flexibility. The reasons for these differences in the pattern of operations cannot be that the owners of the vessels experienced different prices and different kinds of regulation. The prices are probably the same for all the fleets. As far as the fishery management is concerned, in general there are few rules³ which prevent functional flexibility for groups that already participate in the fishing. The restrictions that do exist are directed primarily at the largest ocean fishing boats.

Thus, given mainly the same frameworks as regards prices and regulations, the different types of fleets adapt to often chaotic marine systems in different ways. The mobile coastal and ocean/coastal fleets using active gear exploit the "chaos features" of the marine

³ This conclusion is based on a review of the current regulations applying to the fleet in Finnmark.

systems to a much greater degree than the less mobile coastal and fjord fishing fleets that employ passive gear do.

Does this mean that the mobile fleet chooses more flexible strategies than the less mobile fleet does? The mobile coastal/ocean fishing fleet exploits many species because the fishing technology used gives secondary catches of species other than the one at which the fishing is primarily directed. Trawls are a type gear that do little to generate a type of fishing that is selective as regards the species caught. The not very mobile fjord fishing fleet uses gear such as handlines and nets, which give by no means the same degree of secondary catches. Our interview data shows in addition that the fjord fishermen choose not to fish when there is little cod available, as was the case, for example, during the seal invasions of Finnmark in the 1980s (Eikeland 1993). During such periods, many of them obtain an income from other forms of paid employment, e.g. from sheep, fish farming or construction work. They thus choose a numerically flexible way of adapting to the fishing commons, in contrast to functional flexibility based on a technology that gives secondary catches. In the theories on flexible organization of work, functional flexibility is said to be based on the technology and competence to carry out very different kinds of work. In the fishing sector, we find that the technology and competence are very "rough". They are of a type that "haul in" whatever species they come across. However, this pattern of operation demands functional flexibility as regards processing and selling the fish. The industrial trawlers have adapted this. A new icelandic trawler is "equiped for fishing and producsion of all species, include herring and prawns, in the icelandic water" ("Norsk Fiskerinæring" 11/12 1994).

Thus they impose demands for functional flexibility of fish buying and processing companies.

Flexible management regimes

The challenge to every management regime intended to promote sustainable patterns of behaviour is to motivate the fishermen to switch from fishing a species that is declining to fishing a species that is increasing (Wilson 1990).

Our findings show that certain technologies are more suited than others for promoting multi-species fishing. Or - that functionally flexible fishing generates a specific choice of technology. One aspect of our findings shows that, probably, the functional flexibility as exercised by the fleet in Finnmark is not subject to such limiting factors. There is no such "barrier" to the technology chosen in order to perform functionally flexible fishing. The fact that the functionally flexible fleet is geographically mobile also reduces the possibilities of generating and maintaining the social norms that regulate the use of the fishing commons. Svein Jentoft found that the terms of informal, locally instituted systems of regulation have become weaker since the fishing was modernized. One of the main reasons is:

"the developments as regards fishing technology, and the growth of a strongly capital-intensive sector in the industry. This has, not the least, helped to increase the mobility of the fishing fleet" (Jentoft 1987:383).

The dissolves the stability that characterizes local communities which preserve the social norms. In the Norwegian debate on the fisheries, it is then also representatives of mobile groups of boats using active gear that demand more flexible management (Fiskeribladet 3.11.1994), by reducing the regulation of secondary catches. Thus, a type of regulation that opens up for even greater functional flexibility in the fleet as a whole would primarily serve the interests of the capital-intensive fleet that has to fish the whole year round, and uses technology that exploits many species without distinguishing between how hard it exploits the different species.

Regulations that are adapted to numerical flexibility have been much less discussed in the debate on the Norwegian fisheries, and the possibilities of exploiting this type of flexibility have been clearly reduced during the last five-six years (Eikeland 1994). During the crisis of the cod fisheries, the authorities decided that the opportunity to withdraw from the fishing during periods with poor stocks of fish should be reduced. When the crisis began, a registered fisherman had to earn at least NOK 18 000 from fishing, and could not earn more than NOK 144 000 from other sources. The central government reduced this latter limit to NOK 108 000. During the same period, the

authorities imposed quotas for cod fishing, where the size of the quota for a fisherman in a particular year was determined by the amount he had fished during the previous year. This implied that, even with very low cod stocks, the cod had to be fished. If the fishermen did not do this they could not participate when the stocks increased again. Both these types of regulation are judged to be measures that encourage taxation of populations on the decline. Thus the regulations do not provide sustainable motivation. We also find that this group of fishermen, i.e. small-scale fishermen, exploits very few populations, and they probably harvest these in limited geographical areas in the near vicinity. i.e. in the fjords (Eythorsson 1991, Lunde 1994). A small-scale fisherman said to us that: "We are codfishers, we can fish cod and we want to fish cod. But we have to fish other species because of the regulations. We fish cod in one area, and then we move to another area for fishing so much of other species that we are allowed to sell the cod". While the technology gives the ocean fishermen secondary catches, the small scale fishermen choose secondary catches in order to adapt the norwegian fishery management.

This probability for selective harvesting provides a good framework for a situation where the exploitation is based on social norms developed out from traditional knowledge. This, combined with the fact that this group uses a technology that selects what species of fish are caught, can open up for more flexible regulations. However, the regulations have not been adapted to serve the interests of this group.

I hope that this review of the situation has shown that, when discussing flexible management regimes, it is necessary to specifically define what kind of flexibility the regulations should be adapted to. Regulations that open up for even greater functional flexibility for the whole fleet in a modern fishery industry will primarily support the necessity of the capital-intensive fishing fleet to continue to fish in order to cover investments. Thus they will not solve the problems of the rest of the fleet, only those of this capitalized part of the industry. On the other hand, adapting the regulations to the numerical flexibility of less mobile and non-capital-intensive methods of operation would be a measure that would promote sustainable management - because the frameworks for this fishing could generate a sustainability that is independent of standardized governmental regulations. But maybe flexible single-species regulations will be as useful

as multi-species regulations for the this fishermen.

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