On the management of Cod and Haddock in the Irish Sea

A report produced for the Anglo-North Irish Fish Producers Organisation Limited

By Jon Kristjansson, August 2003

Introduction

Official landings of Cod from the Irish sea have been declining in the recent years. As a result, measures have been taken to reduce cod fishing and a so called Cod recovery (conservation) plan is in force; Certain areas have been closed for cod fishing part of the year. Recently, ICES recommended closure of all fisheries for cod as a targeted species or by-catch.
The fishermen maintain that both the cod- and the haddock stocks are in a good shape and such drastic measures are unnecessary.
The question remains: Has the cod disappeared? If so, how can we get it back. If not, why this mismatch in opinions?
In order to try to answear this question, the Anglo-North Irish Fish Producers Organisation Limited asked me to look through different scientific reports and to do a survey by questioning fishermen and scientists, go to sea, in order to experience the fishery myself.
I was in Ireland 3-14 June to interview people and I spent four days fishing on the trawler 'Sparkling Sea' where I also collected age samples from cod and haddock. Later, the samples were prepared and analyzed in the laboratory.

Management advice

The ICES advice on management of cod in 2003 was (ICES Cooperative Research Report No. 255):
"Given the very low stock size, the recent poor recruitments, and continued high fishing mortality despite management efforts to promote stock recovery, ICES recommends a closure of all fisheries for cod as a targeted species or by-catch. In fisheries where cod comprises solely an incidental catch there should be stringent restrictions on the catch and discard rates of cod, with effective monitoring of compliance with those restrictions.
These and other measures that may be implemented to promote stock recovery should be kept in place until there is clear evidence of the recovery of the stock to a size associated with a reasonable probability of good recruitment and there is evidence that productivity has improved. The current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the operations of the fisheries are unknown, and therefore historic experience and data are not considered a reliable basis for medium-term forecasts of stock dynamics under various rebuilding scenarios."
Relevant factors to be considered in management:

"Although large short-term losses will be incurred in many Irish Sea fisheries, the advised measures are required if the cod stock is to reach a level where it can regain historic productivity. The advice will likely result in greatly reduced harvesting of other stocks where the fisheries take

cod as part of a mixed species fisheries, particularly haddock and Nephrops. However, the current state of the cod stock, and the failure of past measures to bring fishing mortality down to rates that allow rebuilding, mean that more stringent action is required.
Time and area closures for particular fisheries may be a tool in rebuilding this stock, and their effect can be considered in evaluating harvest opportunities for other species.
Diversion of effort from the cod spawning grounds to other vulnerable stocks should also be prevented. It is important that management action being taken to reduce fishing mortality on the adult component of the stock is not compensated for by an increase in fishing mortality on the juveniles.
ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for other species down to near zero, then these programs could be considered in management of such fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent"

The advice on management for the haddock in 2003 was (ICES Cooperative Research Report No. 255):
"Since haddock is mostly taken in demersal fisheries with cod and in a Nephrops directed fishery, the advice for cod determines the advice for haddock. Unless ways to harvest haddock without by-catch or discards of cod can be demonstrated, fishing for haddock should not be permitted."

DARD say in their publication (DARD Fishery Note: September 2002):

High rates of fishing mortality in cod, whiting and haddock have resulted in few fish surviving beyond 5 years of age, ... The fast growth-rates of Irish Sea cod and haddock mean that there is a large potential growth of biomass if mortality is reduced significantly over all age classes, given adequate recruitment of young fish. This is simply a result of allowing more fish to survive to a larger size and weight, by catching a smaller fraction of the stock each year. The economic benefit of catching a greater bulk of fish per hour's fishing, whilst fishing fewer hours in the year, is obvious but has been largely ignored in the "race for fish".

From the above management recommendation it can be seen that the assumptions for the managment, or theory behind it is

1. Large spawning stock will increase the probability of good recruitment.
According to this, ICES has decided that 6000 tons is the lowest acceptable for cod. Below this, the stock is considered to be outside safe biological limits.

2. Fishing mortality is very high, by reducing this, i.e. reducing the catch, the fish will become older and larger and the stock size will increase. This assumes that food is not a limiting factor for growth and increment of the stock.

The state of the cod and haddock stocks

The first question to be answered regards the size of the cod stock. Is it in a poor shape? According to official statistics the catch at the present is in the region 2-4 thousand tons, compared with 8-15 thousand tons in the eighties (Fig.1). ICES estimate the spawning stock to be 4580 tons at the start of 2003 that is, landings are higher than the spawning stock. This must be unlikely.

The view of fishermen

People from the fishing sector, captains, processor etc, all agreed that the state of the cod stock was as good as it was before 1990. Some captains maintained that the fishery was getting better the last few years and was even better than in 1994-1995.
They said that a normal catch in a semi- pelagic trawl was 50-100 kg per hour. This is considerably more than the figures ICES is operating with, which is 17.8 kg/h in 2001 (ICES wgnds 2003, table 8.2.1).
The general opinion of the fishermen was that the low landing figures were a result of mis-reporting, which again was a result of the low quota allocations.

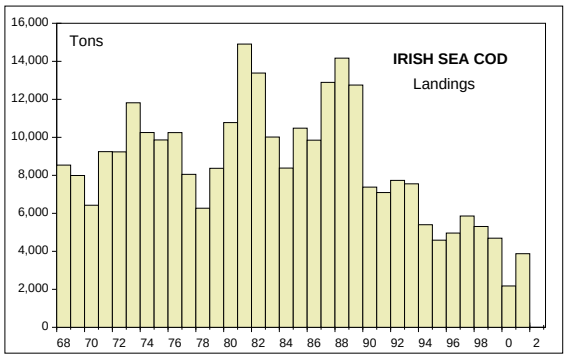

Fig. 1. Official landings of cod from the Irish sea 1968-2001.

Experience from a fishing trip

I went on a four day fishing trip with a trawler from Kilkeel. She was equipped with a semi-pelagic trawl. When towing the trawl was kept as close to the bottom as possible, without touching it. The height of the opening was 12-15 m. There is a transducer on the headline, transmitting signal via cable to the ship so the skipper can see the bottom, footrope and fish entering the trawl. This fishing method requires experience and skill. The trawler was equipped with two high quality echo sounders that were able to register single targets (individual fish).
As in practical fishery, there were areas without fish and areas with fish as it could be judged from the the echo soundings.
The trawl was usually towed for 11-12 hours and the catch ranged from 7- 22 boxes, mostly cod and haddock. Besides mixed hauls, there were clean cod hauls and clean haddock hauls, depending on area and time of day. Haddock lifted off bottom during dark hours and could be registered in quantities by the sounder.
All this seemed very normal to me, we were fishing at fishing grounds with normal dispersal of fish, cod showing up as individual targets, easily counted, well off bottom, haddock showing up in numbers when they lift from the bottom in the dark.
To me, the gear does not seem to be very effective, especially in catching haddock. Towing for 7 hours through dense soundings only gave 7 boxes of haddock and it could be seen (on the sounder) how they escaped through the upper panel, a behaviour which is common to haddock. Cod could bee seen escaping under the footrope, also common behaviour of cod.
Age samples were collected from cod and haddock. Results from the age readings are presented in in Appendix 2.

The science behind the management

The management procedure can be split in two phases:
1. Assess the the stock in weight and numbers
2. Decide and advice what to do when the size and evolution of the stock has been assessed to achieve the desired goal.

The first one usually gets most of the criticism: "It is not possible to count the fish in the sea", "They are always trawling at poor fishing grounds", etc. This will be dealt with in Appendix 1.

The second part often gets less attention but the advice is similar world-wide: Reduce the fishing pressure and protect small fish and the spawners.
As mentioned before the advised method to increase the size of the cod stock (the belief that big stock = big harvest and vice versa) is based on the assumption that fishing is the main factor governing the mortality in the stock and food is over-abundant, allowing increase in population number without reduction of the growth rate of the individual fish.

Fishing mortality

Some decades ago fishing pressure was measured in physical terms, i.e. trawl- hours, boat hours, number of hooks, etc. That was laborious and often not possible.
Now fishing pressure is measured as fishing mortality, (F), the fraction of the stock taken by the fishery. Fish die from other causes than fishing, they are eaten, die from diseases, parasites, old age and other causes. This is called natural mortality, (M).
The sum of these two, F and M, is called total mortality, (Z). It is possible to estimate the total mortality by investigating how the year classes disappear from the stock. This is done by test fishing and/or taking age sample from the catch in subsequent years.
But this only gives an estimate of the total mortality with associated uncertainty. It is not possible to separate F and M. It is not possible to estimate M in a short time period. Therefore fisheries scientists use a 'likely' value for M. It is most common to use M=0.2, which equals 18% per year, for all cadoids (cod, haddock, saithe) i the North Atlantic. This value is used for all ages which have recruited into the fishery.
Thus, if the total mortality is found to be 0,7, then 0.2 is subtracted and bingo: fishing mortality is 0.5!
That cannot be true. M must be variable, sometimes high sometimes low, according to the general condition in the sea. It could be higher for the smaller fish in each age class, higher for spawners than growers, higher for old senile fish, etc.
If, in the example above, the true M was 0.5? Then the fishing mortality would be 0.2, less than half of the first one.
More and more evidence on considerably higher natural mortality is piling up.
Tagging experiments on cod in the Atlantic show very high M, around 1.1 in Icelandic spawning cod 1948-1969 and Shelburn Canada 1926.
According to recent information from Canada total mortality for Northern cod is 40-60% per year at age 4 and 60-80% at age 6, calculated from bottom-trawl survey (DFO 2003. Stock Status Report 2003/018). As no commercial fishing was taking place, this was the natural mortality.
In my opinion, the inability to recognise (understand) the importance of natural mortality is the worst pitfall for modern fishery management.

Reduction of the fishery increases natural mortality, increased fishing pressure removes more fish, leaving better conditions for the remaining ones, thus decreasing natural mortality.

Selective fishing

Protecting small fish in order to 'allow them' to grow bigger is the prime advice of modern management. Therefore measures are taken to protect small fish. This is called selective fishing.
The mesh size in trawls was increased at Icelandic grounds in 1996. Since then, things have gone worse and landings of cod are 50% less now than it was earlier.
Last few years mesh size has been increased in the North Sea and the Irish Sea and the landings are on their way down.
Controlled experimental fishing in lakes have shown that by increasing fishing pressure on small fish, harvest increases. This is because less energy is lost in competition or natural mortality. Predation is reduced and the food chain becomes shorter.
One argument against increased fishing pressure is that fish, particularly young fish, have to be protected so the can participate in the spawning at later stage.
This is wrong, experiments in lakes show that increased fishing pressure on small fish leads to higher number of large fish in the stock. This leads to the next issue, the size of the spawning stock.

Stock and recruitment

The size of the spawning stock is a key parameter in conventional fishery management. The general idea is, the larger the spawning stock the better.
In the course of evolution the size of the spawning stock of many speacies must have approached zero. But they are still here. We only have to think of the Ice age in that context.
Sometimes fish stocks seem to evolve from 'nothing', like the haddock in th Irish sea. Therefore it is vital to get better knowledge of the relationship between spawning stock and recruitment.
Below is a presentation of data from th Irish sea prepared in an unusual manner.

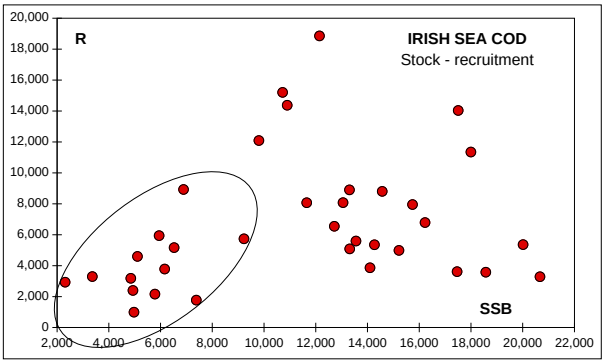

Fig. 2. The classical diagram, used by ICES, to show the relationship between spawning stock (SSB) and recruitment (R). There R is plotted against SSP irrespective of time. It is difficult to see a distinct pattern in the points. It is to be noted that the points inside the circle are from the period after 1990.

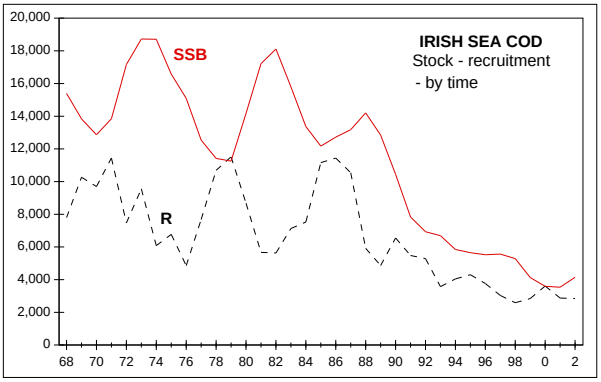

Fig. 3. Spawning stock (SSB), upper line, and recruitment (R) by time (three year running average). The spawning stock oscillates regularly until 1990. Surprisingly, the recruitment swings regularly in an opposite phase. This can be regarded as a self-regulation of the stock size: When the (spawning-) stock is big there is no room for recruits.

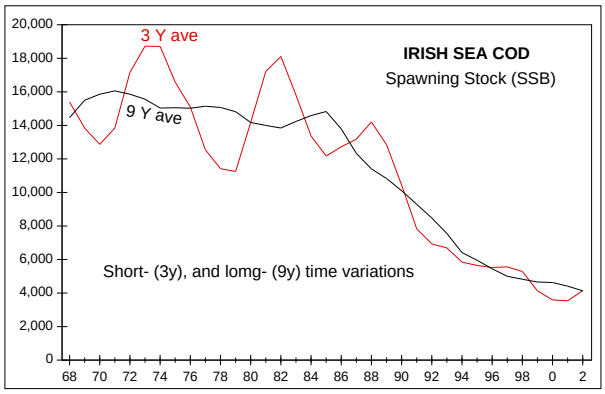

Fig. 4. This is the spawning stock by time. Filtering the data using running average makes the basic oscillations to stand out.
High frequency (short time) noice is removed by 3-year running average. Low frequency (long time) variations appear using 9-year running average.
It can be seen that the spawning stock oscillates around the long term average.

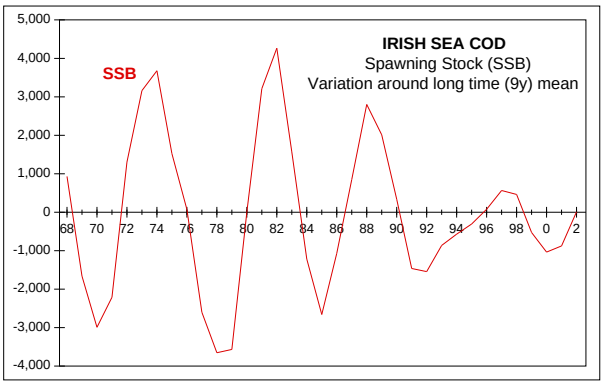

Fig. 5. The difference between the 3-year average and the 9- year average (3 ave - 9 ave) represents the relative short time oscillation of the spawning stock.

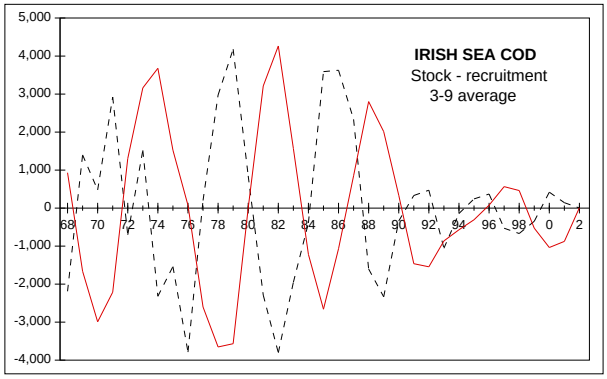

Fig. 6. This is the final workout:
Relative oscillations of spawning stock and recruitment on the same time scale.
Result:
Spawning stock and recruitment oscillate in an anti-phase.

The results from this manipulation do not support the hypothesis that a large spawning stock secures a good recruitment. On the contrary. What we see is that from 1968-1990, the (spawning-) stock is fluctuating, trying to adjust to the environmental and biological conditions, fishing pressure included. Interestingly, the stock oscillates under constant high (relative to now) fishing pressure. It does not take the course either up or down. This proves that fishing by itself does not determine the fate of the stocks. That again explains the poor results of 'managing' fish stocks by reducing the fishing pressure.
After 1990 the fluctuations in both spawning stock and recruitment almost disappear. At the same time the landings (and the size of the spawning stock) decrease at a constant rate. This happens at the same time 'management' starts. Is this coincidence or is it a causative effect? There is only one way to find out: Introduce 'free fishery' without quotas and TAC's against correct catch reports.

Haddock

The management advice for haddock is linked to the management of cod in the way that cod is 'bycatch' in the haddock fishery which should therefore not be permitted. Therefore, in order to allow haddock fishery, the cod problem has to be solved.

Haddock is an opportunist in the Irish Sea (Herdman W.A. and Dawson Robert A. 1902):

"This is a valuable food fish in this district, although it is to some extent variable, occasionally disappearing for a term of years. It has visited the Lancashire coast in large numbers for the last few years, but is now apparently leaving. About twelve years elapsed between the last visit and the previous one."

Only recent data on stock parameters is available, therefore management advice is based on the average catch of the last two years. --which are not very accurate.

In the ICES report it says:

"*The present high availability of haddock in Vlla has resulted in substantial mis-reporting and/ or discarding due to large by-catches of haddock taken by fleets with restrictive allocations available to them...*

The haddock stock in the Irish Sea could be sustained if recent year classes indicated by surveys are allowed to realise their potential for growth, and contribute to SSB. This would only occur if fishing mortality is reduced substantially from the high values recorded in the 1990s."

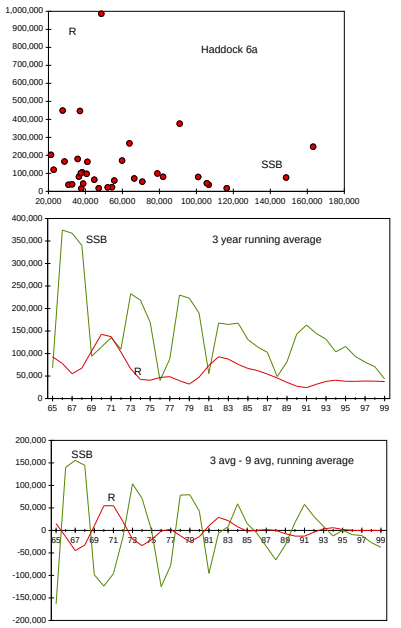

Fig. 7. Haddock west of Scotland.

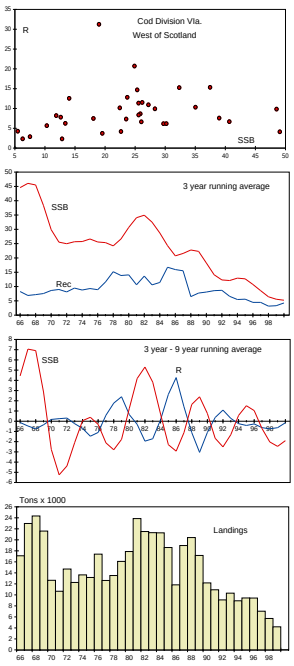

Fig. 8. Cod west of Scotland

Here mis-reporting is admitted. From my interviews with fishermen I felt that haddock was grossly under-reported, and the stock size therefore underestimated.

I disagree on the advice from ICES to ' allow them to realise their potential for growth, and contribute to the spawning stock'.

Firstly, haddock grow very quickly until maturity, then growth ceases and natural mortality increases rapidly. Spawning mortality is probably very high. (experience from Iceland, Faroes, North Sea).

Secondly, there is inverse SSB/ R relationship in some haddock stocks (Faroe, W-Scotland, North Sea).

Finally, haddock is an oportunist in the Irish Sea, and can hardly be kept there against its own will.

Conclusions

1. The cod- and haddock- stocks in the Irish Sea are considered to be normal and not endangered.
2. Total mortality is probably overestimated, natural mortality underestimated and fishing mortality grossly overestimated.
3. Landings are underestimated and the cod- and haddock- stocks therefore underestimated.

Suggestion

Allocate all fleets fishing days according to the fishing pressure in the mid eighties. There should be no TAC's, no quotas, upon agreement on complete and honest catch reports.
Use the data to adjust n.of fishing days in a positive manner i.e. not to harm the fisheries, otherwise the fishermen feel cheated and will not cooperate.
The reason for mis-reporting is the fishermen's experience of their reporting always leading to cuts or restrictions.

References:

Armstrong, M. et. al. 2002: Recent data on composition of whiting, haddock, Nephrops, herring and scallop catches taken in the Irish Sea by fishing vessels from Northern Ireland. DARD Fishery Note: September 2002.

DFO, 2003. Northern (2J+3KL) cod Stock Status Update. DFO Can. Sci. Advis. Sec. Status Report 2003/018. http:/www.dfo-mpo.gc.ca/csas

Herdman W.A. and Dawson Robert A. 1902: Fishes and Fisheries of the Irish Sea, Lancashire Sea-Fisheries Memoir - No. II. London: George Philip & Son, Ltd., Fleet Street, E. C.

Recent ICES reports on Cod and Haddock in the Irish Sea. From the ICES webside: www.ices.dk.

Appendix 1

General methods for stock assessment

(From Armstrong 2002. Four decades of Cod in the Irish Sea: evidence for the decline of the stock. DARD Fishery note: November 2002)

Some general background

The ICES assessment of historical trends in the Irish Sea cod stock is based on a long-established procedure for inferring population sizes from commercial catch-at-age data. If the number of individuals caught from a year class of fish declines slowly over time, resulting in significant numbers surviving to 14-15 years of age or older, the fishery is probably harvesting a small fraction of the stock. If numbers fall away rapidly with increasing age, and there are, for example, few fish older than five years of age, the fishery is probably taking a large fraction of the stock each year.

A general procedure known as a "virtual population analysis" or VPA is used to estimate the fraction of the stock at each age harvested each year (the fishing mortality), based on the age composition of the catches. once this fraction is known, the number of fish alive at the beginning of each year can be calculated from the annual number caught at each age. Fishing mortality is the term given to describe the fraction of the stock killed annually by fishing. It is given here as the percentage of the fish at the start of the year that are caught during the year.

Estimating the trends in fishing mortality and abundance

For most of the history of the fishery, no additional data other than the catches-at-age are required for estimating trends in fishing mortality and abundance. However, the stock trends over the most recent years are poorly defined because many of the fish in the catch are from year classes that have not been observed over their complete life span, and their longevity (which depends on the mortality rate) is unknown. Hence, data on recent trends in abundance from scientific surveys and (if applicable) commercial catch per unit effort are used to "tune" the results of the virtual population analysis over the recent years.

Evidence for the poor state of the Irish Sea cod stock is, therefore, obtained from data collected during two general periods. The most recent trends in stock abundance and fishing mortality are estimated from VPA constrained to follow the trends given by scientific trawl surveys during the -1990s. The surveys also give information on year classes not yet recruited to the fishery, which is important for making short-term forecasts of stock size and catches. During the earlier period from the late 1960s to the 1990s, historical population sizes and fishing mortality rates are obtained by extending the VPA back in time using commercial catch-at-age data alone. It is important to note that the surveys only have an influence in the recent few years of the assessment. The longer-term trends are determined almost entirely by the landings and age composition data. Key features of the evidence for the current state of the stock are as follows:

· Landings declined from an average of about 10,000 t in the 1970s and 1980s to around 5,000 t or below from 1994 onwards. The catches exhibit a very steep age profile, with few fish now surviving beyond five years of age, indicating a high rate of fishing mortality that appears to have increased over time.

· *Abundance indices from trawl surveys in autumn and spring show very similar year-on-year changes to those in the commercial catch at each age in the 1990s, as well as to the VPA estimates of population numbers derived from these.*

Below is a table that shows the survey indices for cod since 1992. Examination of the table shows that no fish older than 3 years is caught in the autumn survey. It should also be noted that there is approximately 5 times higher catch of 2 year cod in March than in October and and similar difference for 3 year old fish. An explanation for this is given by ICES (wgnsds 2003\section8.doc):

Both surveys show similar year-class (cohort) effects, clearly showing the weak 1997 and 1998 year-classes. The estimates of fishing mortality at each age are higher for the October survey (Fig. 8.5.1.2.3), reflecting a steeper age profile that is probably strongly influenced by declining catchability at age. The distribution of mature cod shifts southwards after spawning and extends beyond the southern limit of the October survey. This causes a reduction in the number of stations with adult cod in October compared with March when the bulk of the stock of mature fish is on the spawning grounds and within the area covered by the survey. The NIGFS surveys have been extended southwards into the St George‹s Channel since autumn 2001 to allow better coverage of the distribution range of the stock (additional stations are not included in the XSA tuning data).

	NIGFS (March)							NIGFS (October)		
Year	1-gp	2-gp	3-gp	4-gp	5-gp	6-gp	7+gp	1-gp	2-gp	3-gp
92	2325.7	500.5	196.5	24.8	0.0	3.1	1.7	1109.4	50.1	47.6
93	138.1	648.8	44.6	10.4	1.4	2.8	0.0	553.2	146.4	0.8
94	1380.4	109.7	120.3	8.4	1.4	0.0	0.0	1672.5	25.4	10.4
95	700.7	386.2	20.0	10.8	0.0	1.0	0.0	1206.8	33.3	0.0
96	1106.1	329.3	111.7	1.4	8.8	0.0	1.3	486.6	50.1	6.5
97	537.3	415.8	66.7	21.4	1.4	0.0	0.0	1322.2	97.2	0.0
98	169.4	769.2	56.9	12.0	0.0	0.0	0.0	376.5	163.9	5.7
99	49.5	253.1	241.9	15.3	2.8	0.0	0.0	58.5	32.5	9.5
00	629.6	101.1	34.6	33.0	0.0	2.3	0.0	301.6	2.0	0.0
01	406.7	561.4	18.4	5.8	4.0	0.0	0	506.8	109.9	0.0
02	662.2	253.3	333.5	0.0	0.0	1.1	0			

Table 1. Cod in Vlla. Groundfish survey indices of abundance. Stratified mean nos. per 300 nautical miles (from Table 8.2.2. wgnsds 2003\section8.doc)

In the March surveys nos. of 5-7+ old cod are very low, sometimes zero. Note that the numbers represent appr. 100 hours trawling. After going to sea, pelagic trawling getting only large cod, this is understandable. The big (old) cod are off the bottom. A rock hopper trawl catches them poorly. Also, a small mesh survey trawl does not catch large fish very well because of the pressure wave ahead of such trawl and high swim speed for large fish.

This is very important because the survey us used to estimate the mortality in the stock. Poor catch of large fish (relative to other sizes) 'looks' like a high total mortality in the stock and, as the natural mortality is fixed, (0.2) this is interpreted as fishing mortality. And when all this is "tuned" against missing landing reports, the outcome is overfished cod-less sea.

The parameters obtained from the assessment are not very accurate. An example is given below:

The main changes are the downward revision in the estimate for SSB in 2000 from nearly 4,400 t to about 2300 t, an upward revision in F (2-4) in 2000 and a downward revision of recruitment in 2000. The F vector for 2000 has been substantially altered compared with last year's assessment:

Age:		1	2	3	4	5	6
2001	WG	0.117	1.797	0.964	0.235	0.109	0.355
2002	WG	0.120	0.979	1.454	0.929	2.153	1.521

The high F at age 2 on the 1998 year-class has been revised downwards substantially, and the F‹s at older ages have been revised upwards substantially. The present assessment suggests that the very low F estimates at ages 4 and over in 2000, estimated by last year‹s assessment, were caused by tuning problems rather than a result of the cod closure in 2000.

It is my opinion that surveys cannot be used to quantify fish stocks with acceptable accuracy.
Famous is the blunder from America (named Trawlgate), where the research vessel Albatros IV had been using warps of different lengths for two years, catching practically nothing.
Also, even if the stock size was known, the knowledge of how to harvest the stock for maximum yield seems very vague.
Therefore, this approach to science should be reconsidered.

Appendix 2

Cod											
Age	Weight	Ycl	No	L	l_1	l_2	l_3	l_4	l_5	l_6	l_7
	Kg			cm	cm						
3	1.30	00	3	51	15	30	40				
4	2.10	99	8	61	17	32	46	55			
5	3.95	98	2	76	17	33	48	64	71		
6	5.64	97	2	85	22	35	54	70	76	80	
7	5.72	96	2	86	16	36	55	67	75	81	90
		Sum	17	Avg	17	33	49	64	74	81	90

Haddock										
Age	Weight	Ycl	No	L	l_1	l_2	l_3	l_4	l_5	l_6
	Kg			cm	cm					
1	0.17	02	2	27	19					
2	0.39	01	18	35	18	31				
3	0.72	00	5	43	19	32	39			
4	1.13	99	1	50	17	30	42	49		
5	1.06	98	1	49	14	22	33	44	46	
6	1.72	97	2	58	17	31	43	50	53	57
		Sum	29	Avg	17	29	39	48	49	57

Table1. Age, length and back calculated length at age of cod and haddock.
L = mean length, l1, l2, etc. = mean length at first, second, etc winter. W = estimated weight from length.

Age samples

During the fishing trip scales for from cod and haddock were collected for age determination. Length distribution of the fish sampled is shown in fig. 1. Later, in the laboratory all scales from cod and a proportion of the scales from the haddock were processed and the age determined. Growth was also back calculated, assuming a linear relationship between body length and scale.
The results are presented in table 1 and fig. 2.
This is a very small material and no definite conclusions can be drawn. Old haddock seem to grow to a maximum og 60 cm, younger fish seem to grow up to a lower maximum size.
Cod caught in this trip vas big on the average and the fish seem to be relatively old, maximum age 7 years or more. This is contrary to the general opinion, that cod is caught very young and fishing mortality (total mortality) is extremely high.

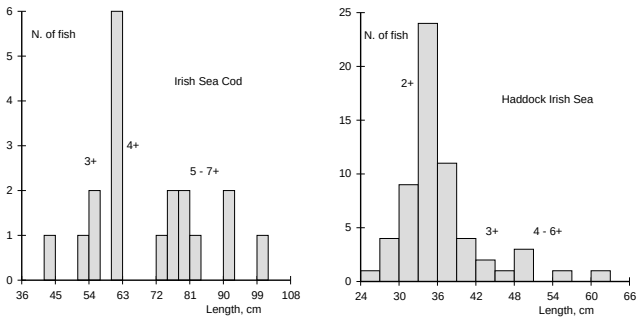

Fig. 1. Length distribution of cod and haddock sampled for ageing.

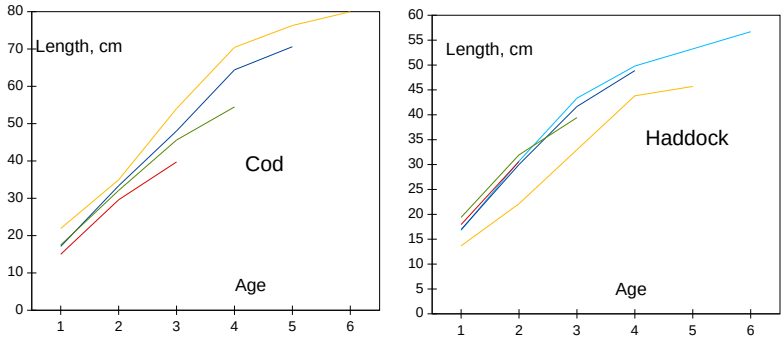

Fig. 2. Growth of cod and haddock. Back calculated lengths at age.