

# The Use of Bycatch Quotas – the North Sea as a Case Study

## **BACKGROUND**

In December 2003, the European Council of Ministers agreed the North Sea cod recovery plan and subsequently Regulation 423/2004 was published in February 2004 establishing measures for the recovery of cod stocks.

This Regulation was adopted after a number of other measures had been introduced in response to concerns over the status of cod stocks in European waters and in particular to the International Council for the Exploration of the Sea (ICES) advice that quotas for cod stocks should be set at zero. The North Sea recovery plan restricted quotas, and introduced effort restrictions in fisheries where cod are caught with other species – namely haddock, whiting, plaice, sole and *Nephrops*.

In their 2005 assessment for the North Sea, Skaggeak, Eastern Channel stock, ICES advised that there is continued substantial removal from the stock and concluded that current assessment efforts and reports from some fisheries indicate that the existing restrictions have not been effective in controlling the catch of cod and subsequently threatens the long-term recovery of the stock.

ICES have advised a zero catch for cod since 2003. WWF has supported the ICES advice and has recommended that directed fishing should not be allowed, however, if fishing was to be allowed to continue any agreed quota should only be in the form of a cod *bycatch quota*.

## **INTRODUCTION**

The following report considers how to implement a cod bycatch quota and what the consequences might be of changing the status of North Sea cod to an annual bycatch quota.

The report describes a theoretical approach for applying a cod bycatch quota in the North Sea; considers some of the management realities in applying the theory and the possible consequences; it describes how bycatch quota is applied in the mixed groundfish fisheries of the North Pacific; and, provides a number of conclusions and recommendations.

On researching the term, “bycatch quota”, no recognised authoritative definition was found<sup>1</sup>, therefore, for the purpose of this report, the following definition has been used:

*“Bycatch quota - A quota set for species considered to be a bycatch in a fishery, where ‘bycatch’ is taken to mean, the catch of non-target species and/or undersize or over quota target species.”*

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<sup>1</sup> See end of references for Internet links used in searching for a definition of “bycatch quota”.

Similarly, in the absence of a recognised authoritative explanation on the principle use of a bycatch quota, the following is used:

*“A bycatch quota is used to limit the mortality of the bycatch species whereby, on reaching the bycatch quota, the fishery or a defined area of the fishery is closed to all forms of fishing likely to catch the species.”*

## **COD BYCATCH QUOTAS IN THE NORTH SEA**

### **The Theory**

In its simplest form, the following sets out a theoretical approach to managing cod as a bycatch quota in the North Sea fisheries:

- **The cod total allowable catch (TAC)** would be set in the same way as it is now.
- **No directed cod fishery** would take place, i.e. all catches of cod in the North Sea would be treated as a bycatch.
- **Fleet categories** would be established for fishing vessels based on the fishing gear and mesh size that they use.
- **Annual cod bycatch quotas** for each fleet category would be set by Member States using their existing systems of quota allocation and management.
- **An observer programme** would be established, placing observers on representative samples of the different fleet categories to record total cod catch, i.e., *total cod catch = retained cod + estimate of discarded cod*. Observer coverage and methodology for quantifying discards would be statistically robust enough to ensure reasonable confidence in estimating total cod catch for each fleet category.
- **Fishery closures** would take place for a fleet category when their cod bycatch quota allocation is reached. The fishery would re-open the following year.

Below, using these bullet points as prompts, further detail and consideration is given to the possible practical consequences of this, “in theory”, approach.

### **Putting the theory into practice**

#### **The cod TAC**

The existing procedure for setting the cod TAC, i.e., in accordance with Council Regulation EC No. 423/2004, for the North Sea would continue. However, with the improved data on fishing mortality levels that an observer programme associated with implementing a bycatch quota is anticipated to provide, the level of confidence in the stock assessments would be significantly improved. In turn, this would provide more robust information on which ICES and the European Commission’s Scientific Technical and Economic Committee for Fisheries (STECF) can assess and provide advice to the Council of Fisheries Ministers. Subsequently, Council decisions would be better informed and should be more “in-tune” with scientific advice.

ICES describe discards and unreported landings as, “missing catch components”, and are estimated by the ICES North Sea cod stock assessment model to be in the region 35-50% (ICES, 2005). ICES have also stated that, until the combined effects of unreliable catch data and the inability of management to control the catch of cod in the various fisheries in the North Sea, the rebuilding of the cod stock cannot be achieved (ICES, 2005). It is anticipated that an observer programme, either with or without bycatch quotas, could provide these missing components, and more (see below).

### **No directed cod fishery**

In order to maximise their available cod quota, it seems likely that fishermen would have to adapt the way they fish. By limiting or avoiding cod catches, fishermen would be able to prolong their fishing season and improve their economic return. For all intents and purposes, this would remove any directed fishery for cod.

With the limited information available on cod catch rates and discards for the different North Sea fisheries, it is not possible to gauge the potential economic impact this would have. However, it seems likely that the majority of the finfish and *Nephrops* fisheries would be closed before quotas of other species are taken. Also, the change in fishing practices and behaviour that fishermen would undoubtedly have to make are difficult to predict as are the potential consequences to other fish stocks.

What might be easier to predict is the adverse reaction that the fishing industry would have to such a measure, likely based on concerns related to the economic cost to the fishing industry in both lost fishing opportunity and a need to invest in more selective forms of fishing.

A potential benefit of setting a cod bycatch quota would be the removal of bycatch limits, i.e., permitted quantities of cod set as percentages of the total weight of the catch and prescribed for different fishing gears, mesh sizes and areas, (see below). At present, in order to stay within these bycatch limits, discarding and/or high grading of catch takes place. This results in undisclosed fishing mortality and, moreover, fishermen are angered and frustrated by the moral and financial absurdity of the system which serves no conservation or recovery benefit for cod stocks. Furthermore, a reduction in the large number of mesh size ranges could also be considered resulting in a simplification and clarification in regulations for both fishermen and national control and enforcement authorities. This might go some way to tempering the adverse reaction that is envisaged. However, without undertaking a more in depth analysis of a cod bycatch quota system and holding discussions with stakeholders it is not possible to know how likely this might be.

### **Fleet categories**

In order to allocate cod bycatch quota among the national fleets it will be necessary to differentiate and group vessels that catch cod. For this purpose, the term “fleet categories” has been chosen as a generic term to describe possible groupings of these vessels.

Fishing vessels in the North Sea are already differentiated; a common approach being to use the species for which the vessel directs its effort and/or the fishing method and/or the size of the vessel. This approach has evolved and been heavily influenced by technical regulations associated with fishing gear, mesh size and permitted levels of bycatch (as mentioned above). For example, a vessel fishing with a demersal trawl, with a mesh size of 70-99 mm, is considered to mainly direct its fishing for *Nephrops* but can also have a significant bycatch of cod and other species. As such the vessel is permitted a cod bycatch limit of 20% by weight of the total catch. A vessel fishing with a beam trawl with mesh  $\geq 80$  mm, is considered to mainly direct fishing for plaice and sole but will catch cod as well as other species and so has a permitted cod bycatch limit of 5% by weight of the total catch (STECF, 2005; European Commission, 1998; European Commission, 2001). Therefore, by design as well as by default, this has enabled fleet categories to be identified.

For the purpose of applying bycatch quotas, fleet categories used in the presentation of results from recent North Sea discard studies are considered to provide a reasonable basis from which to develop an official “European fleet category” list, the assumption being, these studies chose or created distinct fleet categories that are likely to catch cod.

Using gear and mesh size range for the different Member States fishing in the North Sea, ICES describe 25 different categories when presenting landing and discard figures (ICES, 2005). In contrast, in their presentation of similar data, the STECF have rationalised this list and describe 6 different “effort regulated gear” categories with an “other” category representing gears which are not effort regulated and for which gear types have not been precisely defined (STECF, 2005). Table 1 below provides comparison between the two approaches.

**Table 1: Examples of different fleet categories described by ICES and the STECF for the North Sea considered likely to catch cod.**

ICES GEAR CATEGORIES		STECF GEAR CATEGORIES	
Gear	Mesh size range (mm)	Gear	Mesh size range (mm)
Large Beam	$\geq 120$ 100-119 80-99	Beam Trawl	$\geq 80$
Small beam trawl	80-99		
Gill	$\geq 220$ 100-119 120-219	Static net	unspecified

ICES GEAR CATEGORIES		STECF GEAR CATEGORIES	
Gear	Mesh size range (mm)	Gear	Mesh size range (mm)
	90-99 50-70		
Otter	≥ 120 100-119 80-99 70-79 55-69 32-54 16-31 < 16	Demersal trawl	≥ 100 70-99 16-31
Longline	n/a	Longline	n/a
Pelagic Trawl	100-119 32-54 80-99	Other	Unknown
Pelagic seine	32-54		
Demersal seine	≥ 120 100-119 80-99		

Source information: ICES, 2005; STECF, 2005.

The creation of a European fleet category list would obviously require Member State agreement, as would a reference period to take account of any vessels that might have fished in more than one fleet category - the presumption here is that they would be eligible for quota under each category. How “new build” or vessel ownership transfers would be accommodated prior to the implementation of bycatch quota is not clear and would require careful consideration, as would dealing with the under 10 m fleet and large numbers of recreational sea anglers - both categories are capable of catching locally significant quantities of cod.

#### Annual cod bycatch quotas

The North Sea cod TAC is allocated proportionately to seven EU Member States (the United Kingdom, Denmark, Germany, the Netherlands, France, Belgium, Sweden) and Norway. Responsibility for managing national quota lies with the Member State (and Norway) in accordance with European Council Regulations (and bilateral agreement with Norway and the European Community).

The introduction of bycatch quotas need not change the relative stability shares used to allocate cod to Member States or Norway. Nor would it necessarily change the ways in which the Member States and Norway manage or allow quota to be managed as a commodity, i.e., the ability to trade or swap cod quota. However, it would require Member States to adapt their existing systems to allocate quota to the agreed European fleet categories, and to manage it within these categories.

Without knowing the number of categories, the administrative burden of this approach is not clear. Each Member State's fisheries department would need to calculate and allocate cod bycatch quota for all vessels in each fleet category and continue to administer the non-sector, while Producer Organisations (POs) would continue to manage their members cod bycatch quotas within the fleet categories.

The real challenge would be for both the sector and non sector to manage their activities so that they eke out their cod bycatch quotas in an effort to ensure that they are able to continue to fish for other species. The tradable value of cod quota would likely increase significantly as, in effect, its value would represent additional fishing opportunity for cod as well as other species. While this might more accurately reflect the economic value of a limited and declining resource, there could be a knock-on effect with depreciation in the value of quotas for other species. A consequence of this could be a buy up of cod bycatch quota by companies capable of absorbing the cost. Combine this with an unknown but possibly significant profit foregone, resulting from the early closure of other fisheries, the impact could be significant and potentially hasten a reshaping of the industry.

The Norwegians would not be affected by the EU adopting bycatch quotas. Indeed, they may be advocates of a system that better estimates fishing mortality for a resource that they share. In order to better estimate their fishing mortality for cod, the Norwegians introduced a discard ban in the mid 1990s. This was combined with a limited observer/on board enforcement programme and a system whereby areas are opened and closed when bycatch rates become excessive (Dingsør, 2000). If operating effectively, this approach negates the need for bycatch quotas as the discards are taken into account and the total catch is deducted from the quota. Although anecdotal evidence suggests that discarding still occurs, it seems to have stimulated the further development and acceptance by the fishing industry of more selective fishing gears (Clucas, 1997).

### **An observer programme**

The only effective way of operating a bycatch quota would be through an observer programme. Owing to resource and practical constraints, e.g., the cost of total observer coverage, the ability of vessels to accommodate observers, etc., it may be unrealistic to assume that there could be 100% observer coverage. It may be that representative samples from each fleet category would need to be used as the basis for estimating uptake of bycatch.

An observer programme capable of delivering estimates of total catches in the North Sea would probably require observers to be on board 5 - 10% of the vessels (MRAG, 2004). Costs for such

coverage are estimated to be anywhere between € 5.1 - 24.9 million (MRAG, 2004). Table 2 below, shows the estimates for the costs associated with an observer programme that provides this level of coverage.

**Table 2: Analysis of potential costs of an observer programme in the North Sea for both the UK fleet and extrapolation to the whole North Sea fleet (adapted from MRAG, 2004)**

Days observed	UK part of North Sea			Whole of the North Sea			% Value of catch
	Daily price <sup>a</sup> (£)	Days	Total cost (£)	Daily price <sup>a</sup> (€)	Days	Total cost <sup>c</sup> (€)	
5% coverage with present costs/day	725	4,750	3,443,750	1,050	11,875	12,477,355	1.70
5% coverage with projected costs/day <sup>b</sup>	300	4,750	1,425,000	434	11,875	5,163,043	0.71
10% coverage with present costs/day	725	9,500	6,887,500	1,050	23,750	24,954,710	3.41
10% coverage with projected costs/day <sup>b</sup>	200	9,500	1,900,000	289	23,750	6,884,058	0.94

<sup>a</sup> based on actual effort and costs associated with existing UK discard sampling programme.

<sup>b</sup> based on evidence that suggests that as observer programmes expand so the cost per observer day tends to drop.

<sup>c</sup> Calculations for the cost for the EU as a whole are made assuming that the UK is responsible for about 40% of the total effort in the North Sea.

The most expensive estimate provided in the table is approximately 1.68% of the total management costs associated with the North Sea fisheries (MRAG, 2004). If such a scheme were to be adopted, in accordance with Commission Decision 2004/555/EC, Member States would stand to receive up to a 35% contribution from the Community (MRAG, 2004).

The funding options for observer programmes could take various forms. They could be paid for directly through licensing regimes, recovered by the fisheries management authority from the operators or by a central agency (e.g. government or regional organisation). This is obviously something that would have to be considered in a European context. Existing observer programmes in the North Sea are based largely on goodwill and, even without the controversial backdrop of implementing a bycatch quota for cod, a significantly higher level of observer coverage would very likely require legislation to ensure observers are allowed to effectively operate on board fishing vessels.

At the same time as discussing/negotiating these issues with the fishing industries in Member States, the details of an observer programme would also need to be agreed between the Member

States and the European Commission. Among other things, agreement and coordination on common goals and objectives, uniform data gathering methodologies, appropriate observer coverage levels, observer training, administrative systems, etc. would be required.

Assuming that these issues could be resolved it seems likely that an observer programme would need to be gradually phased in to, among other things, “iron out” problems, establish working routines, allow the industry to learn to work with observers, provide assurance that all national fleets experience similar levels of intrusion during observations, and, allow observers and administrators to adapt to the practical reality of operating such a system. Furthermore, given that data provided by an observer programme would likely result in the closure of fisheries before all quotas are taken, Member States would need to feel assured that they could legally, or otherwise, defend the basis upon which the fishery was closed. As such, an important aspect of a phased approach would be the need for a transparent process that is able to demonstrate the level of accuracy in observer estimates of discarded catch, along with proven levels of confidence in representative data from the different fleet categories.

Existing observer programmes in the North Sea (MRAG, 2004) and experience from fisheries elsewhere (see below) provide evidence and informed opinion that suggest a comprehensive programme could significantly improve the level of information and understanding of fishing effort and patterns, discard levels for different species, selectivity of fishing gears and fishermen’s behaviour, as well as contribute to a reduced likelihood of large scale misreporting. In so doing, such a programme could make a significant contribution for improving the chances of rebuilding the North Sea cod stock.

### Fishery Closures

In order to avoid overshooting the bycatch quota, the fleet category would be notified by the quota management body of an imminent closure. The bycatch quota allocation and the extent to which the fleet category is prone to catching cod would obviously dictate how long the vessels within a category could continue to fish. Limited discard studies for different fleet categories in the North Sea have provided estimates of cod discard rates. They also give an indication as to which categories might find it more of a challenge to manage a bycatch quota using existing gear and working practices. Examples are set out in Table 3 below.

**Table 3: Cod landings, discards and discard rates for different fleet categories in the North Sea and Skagerrak in 2003 and 2004.**

Gear category	Reported Landings (t) 2003	Estimated Discards (t) 2003	Discard Rate*	Reported Landings (t) 2004	Estimated Discards (t) 2004	Discard Rate*
<b>Demersal trawl</b> ≥ 100 mm	12,736	1,127	0.08	12,264	2,024	0.14
<b>Beam trawl</b> ≥ 80 mm	5,370	-	-	3,754	3,309	0.47

Gear category	Reported Landings (t) 2003	Estimated Discards (t) 2003	Discard Rate*	Reported Landings (t) 2004	Estimated Discards (t) 2004	Discard Rate*
Demersal trawl 70-99 mm	3,692	2,217	0.38	3,408	1,721	0.05
Demersal trawl 16-31 mm	6	0	0	2	0	0.34
Longline	1,637	-	-	740	0	-
Static net	821	0	-	753	4	-
Other	5,404	0	-	5,862	-	-

Source: STECF, 2005. \* Discard Rate =  $\sum D \div \sum (L+D)$ , where D = Discards and L = Landings

Using data from the table, the beam trawl,  $\geq 80$  mm mesh and the demersal trawl, 70-99 mm mesh categories in the North Sea have the highest discard rates. If they were to have relatively low bycatch quota allocations, it seems likely they would need to review the way they operate or be subject to a foreshortened fishing season.

Closing a fishery before the target species quota was taken would have obvious economic consequences for the fishing industry. From a biological point, the target species, the cod stocks and other species caught as a bycatch would benefit as their fishing mortality would be reduced.

## EXAMPLES OF THE USE OF BYCATCH QUOTAS

A precedent for bycatch quotas in the North Sea has already been set. The Danish industrial herring fishery sets bycatch quotas for juvenile herring and these are counted toward the total quota with the reduction fishery being closed as soon as the bycatch quota or “ceiling” is reached (Zimmerman, 2000; K. Patterson, 2006, pers. comm.) Also, limited information suggests that, in negotiating fishing opportunities with Greenland and Norway, the European Community has purchased additional quota for species that are caught as a bycatch within other fisheries for which the EU has a particular interest (K. Patterson, 2006, pers. comm.).

Outwith the North Sea, one of the longest established uses of bycatch quota within a fisheries management regime is found in the mixed groundfish fishery in the Gulf of Alaska, Bering Sea and Aleutian Islands. The North Pacific Fishery Management Council has used bycatch quotas as one of their management tools since the early 1980s (Witherall, *et al.* 2000).

Foreign fleets once dominated the offshore fishery with the inshore fisheries being more important for the domestic fleet. Owing to the domestic fleets dependence on particular species, additional protection was given to them, e.g., Pacific halibut, species of salmon, crab and herring were called “prohibited species” and “prohibited species catch” (PSC) limits were

imposed on foreign vessels. As result, a precedent was set for fleet-wide bycatch limits that triggered area or entire fisheries closures (Witherall and Pautzke, 1997).

Overtime and with changes in legislation, the fishery became “Americanised” and a domestic fishery has replaced foreign interest. However, the use of PSC bycatch quota has remained and has been used for at least seven different species. However, while conservation benefits of the system are recognised, the bycatch quota system has developed more for reasons of allocation and reducing discards of species that are targeted by other fleet categories, (D. Witherall, 2006, pers. comm.). For example, because of the scale of operation in these fisheries, processing plants are set up to handle a particular species and are not easily able to process others. This results in the potential for large quantities of discards of species that are the target for other fleet categories. As a result, bycatch quotas have been seen as one way to contribute to reducing the problem, (D. Witherall, 2006, pers. comm.).

The effectiveness of the system is dependent upon a, mandatory and industry funded observer programme, which requires 100% coverage on vessels over 49 m with more limited coverage on smaller vessels. Observers estimate and record retained and discarded catch. When a bycatch quota is reached, based on extrapolation across the fleet, all vessels are prohibited from participating in the fishery for the remainder of the season (Witherall *et al.* 2000). The accuracy of discards is statistically proven to be +/- 10% and so allow closures to be upheld when challenged (D. Witherall, 2006, pers. comm.).

Setting aside a portion of the quota at the beginning of the year for use as bycatch in non-target fisheries is a contentious issue with the fishing industry. However, a combination of experience and a general “rule of thumb” that the bycatch quota is within 1% of the estimated biomass of the species has resulted in something approaching an allocation standard (D. Witherall, 2006, pers. comm.).

There has been an economic cost to the groundfish fisheries due to profit foregone with the early closure of some fisheries, e.g., 6, 12 and 14 closures of Pacific halibut fisheries in 1995, '96 & '97, respectively and as a result, portions of fishing quotas for most flatfish species have remained unharvested (Witherall and Pautzke, 1997). However, the dollar cost to the industry has not been calculated (D. Witherall, 2006 pers. comm.). But with the general healthy state of the fisheries (all but one crab stock is considered to be within minimum stock size limits) which has been credited to the cumulative effects of different management measures (D. Witherall, 2006 pers. comm.) the industry, while unhappy to forego profit, is apparently able to withstand the economic loss this creates – this is in direct contrast to the situation in the North Sea, i.e., historically low cod stock levels and the overall poor economic state of the demersal finfish sector.

Fishermen have altered their behaviour and reduced bycatch in response to bycatch quotas and other regulations. For example, different fleet sectors share information to avoid areas of high bycatch rates; a GIS system has been used to identify bycatch hotspots, which is relayed to the fleet. However, because this is a voluntary system, non-participating vessels with high bycatch rates may keep the fleet as a whole from catching the entire quota. Peer pressure has, to some extent, been encouraged as individual vessel bycatch rates are published on the Internet,

potentially shaming individual skippers or owners to improving their bycatch performance (Witherall and Pautzke, 1997; Witherall *et al.* 2000; D. Witherall, 2006, pers. comm.).

Finally, it is worthy to note that the North Pacific Fishery Management Council consider that the use of observers is considered to be an absolute necessity and a key component to the sustainable fisheries programme in Alaska (D. Witherall, 2006, pers. comm.).

## CONCLUSIONS

- It seems likely that the two most contentious issues associated with the introduction of bycatch quotas in the North Sea would be: i) an unknown loss in fishing opportunity and profit for the fishing; and, ii) the feasibility and cost of establishing an observer programme capable of providing the required level of coverage to accurately estimate the total catch of cod.
- The implementation of a bycatch quota would be dependent on an observer programme.
- The main anticipated benefit of an observer programme is improved data for stock assessments.
- The main benefit of implementing a cod bycatch quota is to more effectively monitor and manage the fishing mortality of cod. Both of these are considered by ICES to be precursors for the recovery of the North Sea cod stocks (ICES, 2005).
- An observer programme that supports the implementation of bycatch quotas would need to demonstrate the accuracy and consistency with which it could estimate the total catch of cod.
- European fleet categories would need to be identified. Member States would allocate, administer and manage quota for each category.
- A cod bycatch quota would mean that the majority of North Sea fin fish fisheries would be “bycatch limited fisheries”, i.e., when a fleet category reached its cod bycatch quota it would have to stop fishing.
- The early closure of fisheries will reduce the fishing mortality on target as well as bycatch species.
- It seems likely that fishermen would adapt or change their fishing gear and/or change their behaviour to reduce the bycatch of cod.
- A cod bycatch quota system would remove the need for bycatch limits and potentially reduce the existing wide range of fishing gear mesh sizes.
- A cod bycatch quota system would have no effect on how the cod TAC is allocated to Member States and Norway. ie. Relative stability would not be affected.
- There would be no need to change the way that cod quota is presently administered, i.e., sector and non sector interests would be managed by Producer Organisations and government fisheries departments, respectively.
- In order to predict the potential economic consequence of a cod bycatch quota system, existing information on cod catch/discard rates for those fleet categories that catch cod need

to be improved and estimates, likely based on fleet category track records, for bycatch quota allocations would need to be set.

- It is anticipated that the tradeable value of cod quota would significantly increase. Larger enterprises, able to absorb the cost, may buy up cod quota. Combined with the potential economic loss caused by the early closure of fisheries, it may be impossible for smaller or less economically secure enterprises to remain in business. In order to salvage something from their business they will likely sell their quota to those who can afford it.
- Examples of the use of bycatch quotas are limited. A precedent for bycatch quotas has been set within the North Sea. The example from the North Pacific confirms the need for an accompanying and comprehensive observer programme and shows that fishermen's behaviour changed, partly as a result of bycatch quota, in attempts to reduce catching certain species.
- With improvements in the data that an observer programme could provide, it may be possible to identify areas within which bycatch quota would apply, e.g., a distinct area where a fishery operates thereby allowing for area, rather than, total closures.

## **DISCUSSION AND RECOMMENDATIONS**

The challenge for the North Sea cod recovery plan is how to implement a single species recovery plan within a mixed fishery while continuing to allow directed fishing for cod and methods of fishing that have limited or no selectivity for cod. A bycatch quota system may provide a potential tool that could allow such a regime to exist, however, considerable work will be required to convince the fishing industry and administrators of the feasibility of such a system.

In researching this report and in recent informal discussions with fishing industry representatives on a variety of issues, it appears that the industry are more willing to discuss and consider ways in which improved levels of information can be gathered and used to better inform the management process. The use of observers is an obvious option and appears, at least by some, to be potentially more acceptable for their members.

In reviewing how a bycatch quota system could be applied it is clear that the observer programme is the crucial component. Ensuring that this is operating effectively is a pre-requisite for a bycatch quota system. Given the likely derision, scepticism even hostility that a bycatch quota system is considered likely to imbue there may be merit in focusing on establishing an effective observer programme before advocating bycatch quotas. At this stage of implementation of the North Sea cod recovery plan there may be greater opportunity and likelihood of improving the existing observer programme without associating it with a cod bycatch quota. It may even be the case that a bycatch quota is not necessary with accurate information on the total cod catch, fishing effort and fishing patterns, stock assessments will be more accurate and the management process will be much better informed.

Given this initial bycatch quota study and the work that WWF Scotland has already commissioned on observers programmes they are well placed to open lines of communication

with the European Commission and the fishing industry on taking forward the development of a comprehensive observer programme in the North Sea and consideration of bycatch quotas.

It is recommended that:

- 1 WWF either undertake or encourage the European Commission to undertake a feasibility study to better inform and understand the consequence of a cod bycatch quota system in the North Sea, e.g., what would be the likely fleet categories and their bycatch quota allocation, when and which fisheries would likely close and at what would be the profit foregone to the industry.
- 2 Given the vital role that an observer programme would have in monitoring cod bycatch quota, additional information to that afforded by the WWF funded MRAG study is required, in order to:
  - i. confirm the level of observer coverage that would be necessary to provide an appropriate level of confidence in representative samples of fleet categories;
  - ii. fully consider the practical aspects of placing observers on vessels in the North Sea; and,
  - iii. provide evidence that observers could consistently provide accurate estimates of the level of discards of cod.
- 3 In advocating the development of an observer programme WWF should consider seeking the views and support from the Norwegian fishing industry and government on the improvement in EU management of North Sea fisheries.
- 4 In considering improvements in the North Sea cod recovery plan, WWF should, initially, use the MRAG report - "Observer Programmes: Best Practice, Funding Options and North Sea Case Study"- as the basis for discussion with the fishing industry and the European Commission. Secondly, WWF should also discuss the application and possible consequence of a bycatch quota system with the fishing industry and the European Commission.

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Glossary of terms used in the search for a definition for “bycatch quota”:

<http://www.fao.org/fi/glossary/>

[http://www.ncfisheries.net/stocks/defsa\\_c.htm](http://www.ncfisheries.net/stocks/defsa_c.htm)

[http://www.nefsc.noaa.gov/techniques/tech\\_terms.html](http://www.nefsc.noaa.gov/techniques/tech_terms.html)

<http://www.afma.gov.au/information/glossary.htm>

<http://www.fishbase.org/search.php>

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