Kennisvraag H-AKV-139: Fully documented fisheries Initial Advice

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Report number C178/10

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Publicatiedatum: 29 December 2010

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Contents

Question

Hoe zou een pilot voor fully documented fisheries in platvis visserij in 2011 opgezet moeten worden?

How would a pilot for fully documented fisheries in flatfish fisheries in 2011 be set up?

Summary

This document outlines some initial thoughts on what would be involved in setting up a pilot study for the use of a fully documented fishery (FDF) to allow for a system of catch quota management (CQM) in the North Sea flatfish fishery. Regulatory requirements, practical considerations and some analyses to determine the likely participation within the Dutch beam trawl fleet are also presented.
Setting up the pilot study would involve a number of key steps:

1. Determine the practicality of such a pilot project: is a fully documented flatfish fishery possible given current technology and resources?
2. Design the pilot project plan: practical aspects.
3. Experimental design: scientific considerations.
4. Implement the pilot project.
5. Evaluate results: in terms of ability to document catches, effects of CQM on the stock and on fishing behaviour, and scaling results up to provide advice on what the likely consequences of a full scale FDF and CQM would be.

Further work would be required to answer all these questions and determine what observations, data and methods would be necessary to implement and evaluate the results of such a study.

1. Introduction

This document aims at answering the kennisvraag question for the Ministry of ELI. To this end, we first evaluate a number of potential issues using existing knowledge and available data from the Dutch beam trawl fleet. However, it should be noted that currently little is known about fully documented fisheries on industrial flatfish fisheries. The document concludes with a number of key concerns when implementing a pilot study for a fully documented fishery.

The purpose of a fully documented fishery (FDF) to allow for a system of Catch-Quota Management (CQM) to be implemented. CQM aims to encourage/incentivise a more efficient fishery by shifting the management output regulations to be based on total *catch* rather than *landings*. This necessitates the needs to be able to document fully the entire catch of a fishery, rather than just the registered landings.

In a CQM-regulated fishery, minimum landing size (MLS) still applies. So fish below this MLS will still be discarded (as opposed to a discard ban management approach). However, they are still counted against the overall catch, contrary to current regulations where discard amounts are quantified, but do not come with costs on the operating business level. This CQM regime allows a fisher to optimize its fishing operating profits by catching less fish below the MLS. In such a situation, reducing discarding or high-grading (through more efficient fishing practices) is beneficial for the fishers because it allows landing a larger amount of fish. Through this CQM mechanism, the incentive of increasing catch quota is hoped to reduce the discarding rates and ultimately decrease the total level of fishing mortality exerted on the stock.

To be successful, this pilot project would need to prove that an effective estimation of total catch by vessels can be made and that the incentives, in terms of increased quota, would lead to reduced discarding and no increase in overall fishing mortality. Viewed in the simplest way, the percentage increase in quota allowed should be less than the percentage of the catch that is currently discarded/high-graded. In other words, for fishers to benefit from their increased catch quota it would be necessary for them to fish more efficiently, in terms of avoiding discards, than they do at present, thereby reducing discards and total F while increasing their landings.

2. Issues for consideration

Administrative regulations

Existing regulations that may have an impact on the pilot study would be: (i) regulations pertaining to fully documented fisheries (FDF), (ii) the control regulation, (iii) the North Sea flatfish long term management plan (LTMP), and potentially (iv) management plans of other species e.g. the cod recovery plan. No specific regulations with regards to a FDF for North Sea flatfish exists. However, such regulations have been formulated for cod and these regulations could be indicative of what is possible for a flatfish FDF. For cod in several management areas, EU Council Regulation No 219/2010 states, among other things, that:

"In addition to this quota, Member States may allow vessels participating in initiatives regarding fully documented fisheries to make additional catches within an overall limit of an additional **5 % of the quota allocated to that Member State**, provided that:

- the vessel makes use of closed circuit television cameras (CCTV), associated to a system of sensors, that record all fishing and processing activities on board the vessel,

- all catches of cod with that vessel are counted against the quota, including those fish below the minimum landing size,

- the **additional catches are limited to 30 % of the normal catch** limit applicable to such a vessel or to an amount which is justified as being capable of ensuring that there will be no increase in the fishing mortality of the cod stock"

The increase in Member State quota of 5% should be more than adequate for a pilot study for the Dutch flatfish fleet. It is not certain how the 30% increase limit for vessel catches was derived, in particular if this is relevant for vessels landing cod only. However the statement "*an amount which is justified as being capable of ensuring that there will be no increase in the fishing mortality*" suggests that an alternative value could potentially be calculated for the flatfish fishery that would reduce overall F while still providing an adequate incentive for fishers. However, the lack of any specific regulations or agreements for the flatfish fishery means that no increases in national quota are likely to be allowed. Any increases in fleet quota would probably have to be derived from the 2% extra quota for scientific research allocated in the control regulation or withheld from the Dutch national quota specifically for the purposes of the pilot study.

The current NS flatfish LTMP contains harvest control rules (HCRs) which are used to set the total TACs for the sole and plaice stocks in the NS. Under current legislation, these TACs apply to landings only. In the Netherlands, the TAC share is distributed among individual vessels in individual transferable quotas (ITQs). These ITQs pertain to landings. An FDF regulation, such as that which exists for cod (above), would pertain to catch levels. Hence this would supersede any restrictions likely to arise from the current flatfish management plan (EU 676/2007) i.e. the management plan is used specifically to calculate the total TAC for *landings*, while a FDF regulation would allow extra *catch* above the values arising from the HCR in the LTMP.

Vessels may be restricted by other management/recovery plans besides the NS flatfish LTMP, for example bycatch/discarding of cod may need to be regulated.

It is assumed that the repercussions of exceeding catch quotas would be the same as those for landings quotas. In other words, once a vessels catch quota has been met, fishing activities need to stop because guarantees of not catching a certain species cannot be given. A system for the transfer of individual quota between and among fishers, should be considered as a complementary regulation on the CQM. Buying or renting extra quota is a way to continue their fishing operations during the year, though the question of whether rented landings ITQs during a year will also have the additional percentage quota increase under the FDF needs to be considered.

3. Fleet considerations

Vessels' participation in CQM is voluntary. Their participation in the scheme is conditional on full documentation by CCTV cameras, recording sensors and data storing (i.e. FDF).

The kennisvraag pertains to the flatfish fishery, so presumably focuses on sole and plaice. As discarding rates for sole are low, it is only likely that a small raise of sole catch quota can be allowed without increasing F on the stock. However, given the high value of sole, a small increase could represent a valuable return. Discard rates of plaice are much higher (in part due to the mismatch in MLS and mesh size for this species), so larger increases in quota are possible. This suggests that incentives to avoid plaice and sole discarding could be effective. The logic of CQM is that a fishery must stop when the catch quota is exhausted. Consequently, in mixed fisheries the fishery must stop if one of the species quotas is exhausted. This will challenge the fisher's ability to plan and conduct his fishery. This may also mean that vessels that rely predominantly on sole may be less likely to participate in a pilot study as exhausting a plaice catch quota may prevent further fishing before the sole quota has been caught. Considering this it is recommended that the focus of the FDF fishery lies on the species most likely to be targeted by vessels rather than all the species caught in the mixed fishery (i.e. focus on sole and plaice, not dab, turbot, bril, lemon sole etc.).

Vessels fishing with gear >90mm (e.g. 100mm or 120mm) have considerably lower discard rates of plaice (and sole) than those fishing with 80mm gear. This implies that vessels fishing with larger gear can only be afforded a low increase in catch quota if overall F is to be reduced. Most 100mm vessels fishing for plaice in the North Sea are under the UK flag, therefore restricted by UK TAC quotas etc. There are no Dutch vessels (under the Dutch flag) that fish exclusively with >90mm gear (Figure 1). This would mean an increase in plaice quota as an incentive for Dutch vessels (which predominantly use 80mm for at least part of the year) would need to be high to encourage participation.

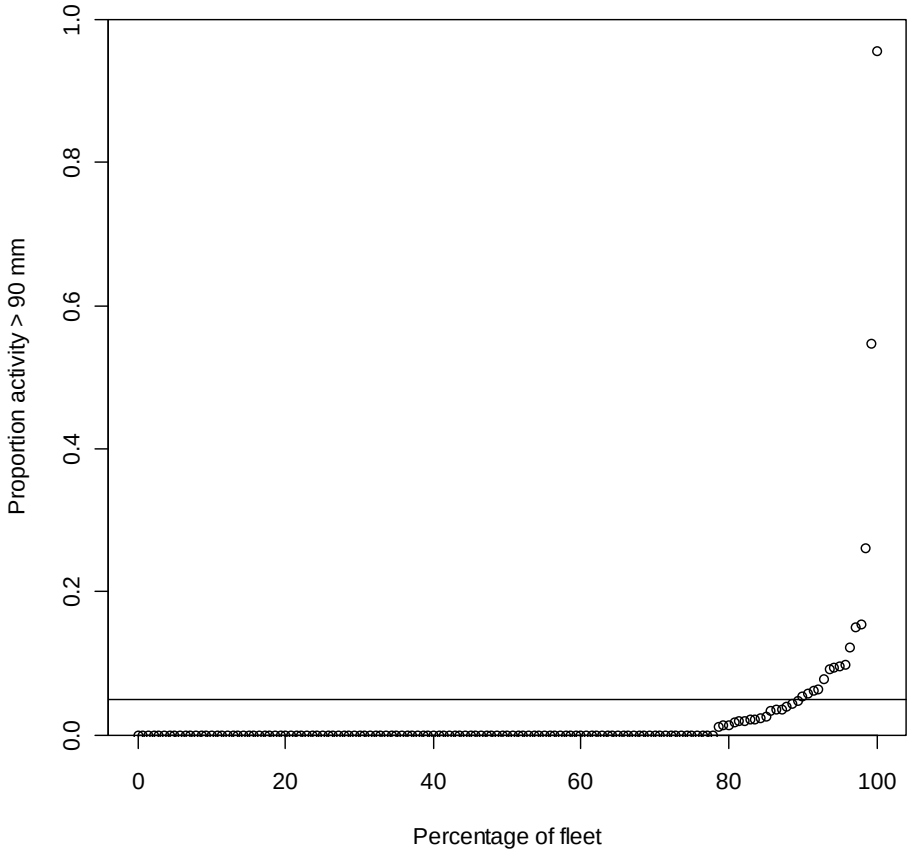

FIGURE 1. PROPORTION OF FISHING ACTIVITY IN 2009 BY VESSELS OF THE DUTCH FLEET USING GEAR WITH MESH SIZE >90MM. THE BLACK LINE SHOWS 5% OF FISHING ACTIVITY USING >90MM GEAR.

Market prices for sole are in the order of five times greater than those of plaice. This means that increases in plaice quota will likely need to be substantial for changing to a FDF to be considered as beneficial to the fishers. Also, the FDF regulation is based on already existing quotas. So if a vessel's plaice quota is low, there will be little incentive to participate. It is likely that only 80mm vessels that earn more from plaice than for sole would find an increase in plaice quota as an incentive for them to move further up north or change gear size.

Individual vessels in the Dutch beam trawl fleet show a broad range of reliance on plaice vs sole (Figure 2). Only a few vessels fish exclusively sole or plaice and there is almost an even spread in between. However, the difference in value between the two species means that more than 95% of the vessels derive more income from sole than plaice. This suggests that increases in both sole and plaice quota should represent an incentive for most vessels in the fishery, while increasing plaice quota alone may only appeal to a few vessels. Once a vessel has fished up its sole quota, if it still has plaice quota remaining it could potential change its fishing behaviour to land this quota without catching any more sole (which would be forbidden). However, should a vessel catch its entire plaice quota before it fills its sole quota, fishing exclusively for sole may not be possible. In this case the remaining sole quota may not be able to be landed legally. Hence, vessels that catch a higher proportion of plaice are more likely to be willing to participate in a FDF.

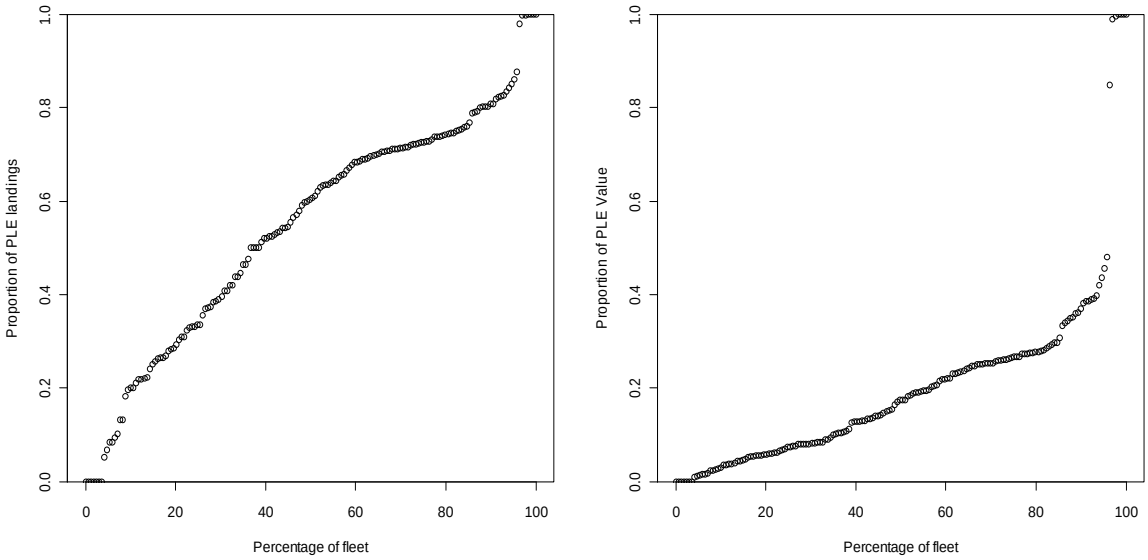

FIGURE 2. PROPORTION OF PLAICE (VS SOLE) LANDINGS (LEFT) AND VALUE (RIGHT) BY VESSELS OF THE DUTCH BEAM TRAWL FLEET IN 2009.

Participating in a FDF will require extra effort from the fishers participating (and this needs to be in front of the camera). E.g. catch per haul needs to be weighed, log book registrations of under-sized plaice should be made (to be checked with video footage) etc. Previous pilot studies noted that before the fishers committed to the project their main concerns were related to the ethical (privacy) issues about being monitored, and the crews' reaction to this. However it was found that in a short time the crew accepted the video monitoring and did not find it problematic or disruptive for their normal working procedures (Dalskov and Kindt-Larsen, 2009).

4. Allowable quota

If a regulation for a flatfish FDF was developed in line with the cod regulation, this would imply an upper limit to the joint quota of the fishing vessels participating in the pilot study. The 5% increase in national quota allowed (or 2% scientific quota from the control regulation) would lead to a maximum amount of additional quota that could be distributed as an incentive to participate. The 30% increase in vessel quotas cannot be allowed to exceed this maximum additional quota. Mathematically, 30% of the sum of the vessel quotas must be the same or less than 5% of the national quota:

$$0.3 * \text{SUM(Vessel quotas)} <= 0.05 * \text{National Quota}$$

Therefore:

$$\text{SUM(Vessel quotas)} <= 0.17 * \text{National Quota}$$

So the vessels participating in the pilot project would between them have to represent less than 17% of the national landings. This means that vessels that currently have a very high quota may have to be excluded from the pilot.

As an example we can apply this to the 2010 quota levels. The national quota for plaice in the Netherlands in 2010 is 22907 tonnes (EU Council Regulation No 219/2010). A 5% increase in quota as in the cod case implies a national quota increase of roughly 1150 tonnes. If vessels can only increase their landings by 30%, the total landings of participating vessels participating cannot exceed 3833 tonnes.

The national quota for sole in the Netherlands in 2010 is 10571 tonnes (EU Council Regulation No 219/2010). A 5% increase in quota implies a national quota increase of roughly 529 tonnes. If vessels can only increase their landings by 30%, the total landings of participating vessels participating cannot exceed 1763 tonnes.

5. Practical considerations

Effectiveness of the video monitoring system

Implementing a FDF pilot study requires more than only installing cameras on fishing vessels. These systems have not been tested on primarily flatfish targeting fisheries, so their effectiveness for such a fishery is uncertain. There are also technical issues with the systems that may require expert knowledge to resolve.

A previous pilot study in Denmark (Dalskov and Kindt-Larsen, 2009) found that image recording of catch sorting can with a high degree accuracy be used to verify the actual amount of fish and shellfish that are discarded, dependant on the set up of the video cameras and the catch sorting working area. If the vessel had a conveyor belt it was very easy for the viewer to analyse the discards. If the sorting table onboard was small and the discard chutes were small or narrow the time required to analyse the images increased significantly. However, they also found that it was difficult for the viewer to estimate with accuracy when a large number of fish were discarded (as if often the case in the flatfish fishery) and there was a clear tendency for the viewers to underestimate discards in these situations.

While the system is currently considered to be effective and easy to count cod (Dalskov and Kindt-Larsen, 2009) and estimate cetacean and other sea mammal and sea bird bycatch (Kindt-Larsen and Dalskov, 2010; Tilander and Gunnar Lunneryd, 2010), it may be not so easy for plaice and sole. Current video footage (not obtained from the Archipelago EM system) suggests that species identification and accurately sizing flatfish on a conveyer belt using such footage could prove challenging. Video footage would examine the fish only after selection of landed fish has been made, which may improve the efficiency of identifying individual fish. It is likely that cameras will need to be close to the conveyer belt (30cm or so), and it will need to be well lit.

It is essential that the efficiency of the video system for estimating total catch of flatfish is established as this is crucial to the effectiveness of a FDF. Should the move to CQM be accompanied by a discard ban, the utilisation of video data should be easier (i.e. video footage would only be used to ensure that no fish were discarded). A discard ban would however lead to an increased workload for the fishermen, with greater sorting obligations and higher demands on space.

Data and analysis

A large amount of data is produced that needs to be analysed on a 'realtime' basis. This is particularly true towards the end of the season as vessels near their quotas. Once a catch quota has been filled, fishing must cease. Both sensor data (GPS, hydraulic and winch rotation) and video data (four cameras) are produced. Sensor data provides a detailed record of the fishing trip including: the start and finish times of the fishing trip, the vessel's speed and heading and the operation of the hauler. This allows identification of key vessel activities including transit, gear setting and gear retrieval. Video data is used to document catch handling and to assess the amount of fish caught for comparison with the catch amount recorded by the crew. Video data can be analysed using a proprietary software programme, Video Analyzer, supplied by Archipelago Marine Research Ltd. Video sequences can be viewed from all camera angles simultaneously and the speed of playback can be controlled. A 10% audit or sampling level has shown significant accuracy with these systems in the British Columbia groundfish fishery in Canada (Stanley *et al.* 2009).

Previous applications of FDFs have examined 10-20% of the hauls per trip (Dalskov and Kindt-Larsen, 2009). If no obviously problems are detected (video estimates agree with logbook values) this is deemed sufficient, if issues are encountered then the rest of the trip footage is examined. This represents a large data analysis burden.

Data will need to be analysed on an on-going basis. While the data storage capacity of the system is large and allows for long periods (3-4 months) between collection of hard drives, in practice data needs to be analysed more frequently. If discrepancies are found between the video monitoring data and reported catch data then the full trip video monitoring data needs to be examined. Meanwhile the vessel in question should not be fishing. Hence there is a need for rapid data analysis. Fishing vessels participating in the NS flatfish fishery generally fish from Monday to Friday, completing roughly 40 two-hour hauls per trip. Ideally video data is analysed over the weekend before the next fishing trip begins. Alternatively, data could be analysed with a one week lag.
A minimum of 10% of the data for each trip equates to ~4 hauls per week for beam trawl vessels. The sorting time is approximately 30min. Thus, two hours of video footage needs to be analysed weekly for each vessel. Analysing a full trip entails examining 20 hours of video footage. Footage may need to be examined in slow motion, especially when technicians are still learning the system, so actual data analysis may initially take longer than video time. However, it can be expected that more experienced viewers will require less time for image analysis. Video footage can be analysed at different speeds ranging to a maximum of 16 times real time. The cod experience suggested speeds ranging from 1.5 to 4 times real time were most commonly used (Kindt-Larsen and Dalskov, 2010).
While the estimates of time required would depend on how efficiently the system works for flatfish, it is certain to be a large load, even for a pilot study. Exactly who will provide (and fund) the expertise required is uncertain. Involvement of the AID is mandatory, since there is a need to check data for quota regulations.

Technical aspects

During the pilot study this work will be very hands-on. There are practical implications of having the CCTV cameras. Trained technicians are required to install the system on-board, regularly collect the data and check the systems occasionally. Hard drives with data would need to be collected (and replaced) from each vessel participating in the pilot project at the end of each trip (i.e. every week). This could be difficult if vessels are located at distant harbours.

6. Practical implementation

Setting up the pilot study would involve a number of key steps:

Step 1: Determine the practicality of a FDF for flatfish.

As mentioned above, before launching a FDF, or even a pilot study, it is essential that the appropriateness of current technology for the flatfish fishery is determined. This would involve testing whether catch quantities and sizes can accurately be estimated. As a side benefit, the likely interest of fishers in participating in a full scale pilot project can be gauged by seeing how willing they are to have cameras on board for this initial evaluation phase.

Equipment and costs

The CCTV surveillance system commonly used is produced by Archipelago Marine Research Ltd. It has successfully developed and deployed video based electronic monitoring (EM) on a variety of fisheries, gear, and vessel types (McElderry et al., 2005, McElderry et al., 2006, McElderry, 2008).

Installations costs per vessel (including costs of equipment and labour etc.) amount to roughly €10 000 - €20 000. There are then ongoing costs with regards to collection of hard drives, video and sensor data analysis, and maintenance of the system.

Using camera systems in an FDF is likely an expensive operation, considering the costs of collecting and analysing footage. Currently, no existing structure is set up to deal with this. Cost effectiveness of this system can be established by comparing it with the traditional monitoring method, i.e. using on-board observers. In this regard the video system is likely to prove a cheaper alternative for a CQM system.

Step 2: Design the pilot study plan.

Designing the pilot study will require input from scientists, industry and the ministry. A number of key questions involving vessel participation and the setting of catch quotas need to be addressed:

Which stocks?

For the sake of simplicity, it may be best that catch limits are only applied to targeted, 'important' catch species. The pilot study could be applied to either plaice, sole or both stocks. The mixed nature of these fisheries suggests that both stocks should be included.

Which fleets/metiers should be included?

Given that vessels can change between metiers during the year (for example by changing gears) selecting vessels by metier would not be a good basis. The beam trawl fleet, of which some vessels currently have reasonably high discarding rates, twinrig Nephrops targeting vessels and gillnetters are potential candidates.

How to select particular vessels from within these fleets?

The pilot study should optimally include vessels that presently cover a range of different discarding rates. Ideally this would be representative of discarding rates within the fleet in order to extrapolate results to the effectiveness of a FDF on a fleet wide basis. Obviously, vessels which currently have low discarding rates are likely to benefit most from increases in catch quota but it is important that the pilot study does not only include vessels with low discarding rates.

To draw conclusions of the likely impact of FDF and CQM on the fishery as a whole a spread of vessels across different gear types may be useful.

One set of vessels that may be a likely candidate for inclusion in a pilot study are those currently participating in the self-sampling program (25 beam trawlers and bottom trawlers). The advantage of these vessels is that they have an historic record of discarding behaviour in recent years and they will be collecting samples on board that can be compared with video estimates of discards to evaluate the effectiveness of the video system. However, their participation in a CQM fishery may compromise there value as estimators of national discarding rates that are used in the assessment of the stock (the DCF self-sampling program).

Ideally the fishers themselves should be consulted to determine the likely participation and potential pitfalls and benefits of a pilot study like this. Potentially a 'kenniskring' could be established to assist in this regard.

Calculating quota increases

A successful CQM fishery would see a reduction in discard rates. A number of factors can influence the rate of discards of both plaice and sole in the catch. The predominant factors in this fishery are likely the selection of mesh size and fishing location. Other factors include the time of fishing (day/night), gear type (gill nets, pulse trawl etc.) and fishing speed. Larger mesh size and more northerly fishing have lower rates of discards. Vessels can change both gear and location during the fishing season. Theoretically vessels fishing with 80mm could be allowed a greater increase in plaice quota than those that are fishing with 100m, because there is a greater scope for reducing discard rates (e.g. incentive to change mesh size).

Determining the likely impact on the stock of increased catch quotas and (potential) decreases in discard rates would require some detailed analysis. Discarding rates are presented in terms of proportions of weight in the catch. However, 1kg of discards does not correspond to 1kg of marketable size fish. Young fish of discard size experience both natural mortality (loss) and growth (gain) before reaching marketable size. In addition, a fishery targeting fewer discards would exert a different selectivity pattern on the population. All these factors will combine to have an effect on the total F (especially the mean F for ages 2-6) that would require a deeper analysis to fully understand the likely impacts.

Using current discards data it is possible to roughly estimate what levels of additional catch could be safely allowed without increasing fishing mortality. Yet additional catch percentages should be calculated on the basis of not increasing F, which involves more than examining proportions of discarded/landed weight within the catch, as mentioned above.

It may be prudent to only estimate the allowable increases in catch quota once the participants in the pilot study have already been determined. This will help ensure that the increase in quota relates specifically to the discarding rates of participating vessels (if these can be estimated).

Vessel participation and quota increase

The amount of vessels participating is likely to depend on the incentives that are being created by the rules of the pilot project. In the Danish example, DTU-Aqua found 6 vessels prepared to collaborate. At least one full fishing season would be required. The pilot project of DTU Aqua was extended for another year and more vessels are willing to participate.

The selection of vessels for participation within the pilot study involves the consideration of a number of factors: willingness of participants, which metiers to include, historic data available by vessel, predicted discard rates of vessels etc.

It is uncertain exactly how successfully fishers can target marketable fish only given efficient fishing practices. So whether fishers see these potential quota increases as incentive enough to change to a catch management system is uncertain. Therefore launching a pilot study may require some negotiation over the plaice and sole catch quota increases by vessel (within the 5%increase of national quota allowed to the Netherlands).

In order to estimate likely participation, the assumption can be made that a vessel would participate in a FDF if the discarding percentage is less than the increase in quota . In the case of plaice there is a large range of discard rates among vessels, from less than 10% to almost 100% for some vessels (Figure 3). If the percentage discards (x-axis) is interpreted as potential quota increase, then the participation in the CQM fishery can be estimated from the percentage of vessels with discard rates at this level or lower (y-axis). In Figure 3 the blue arrows represent potential quota increases (30, 50 and 80%) and the corresponding expected participation of the fleet (in %) can be read off the y-axis: 19, 56 and 95%, respectively. To the left of the red arrow, discard rates come from only 100mm TBB vessels, which discard on average less than 10% of their catch.

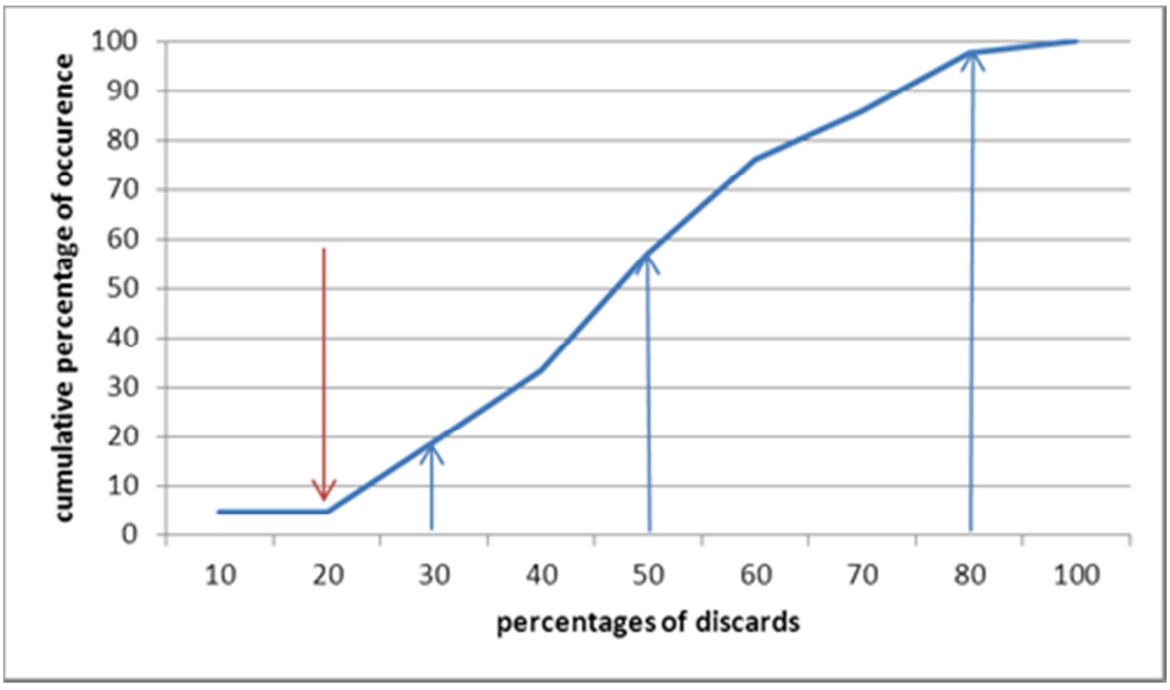

FIGURE 3. CUMULATIVE DISTUBUTION OF THE PERCENTAGE OF PLAICE DISCARDS FROM VESSELS PARTICIPATING IN THE NORTH SEA FLATFISH FISHERY AVERAGED OVER THE YEARS 2005 TO 2009 (HELMOND AND OVERZEE, 2010)

It seems there are four options to consider in terms of catch quota incentives for plaice, each of which are likely to encourage participation from different segments of the fleet:

1. 30% increase in catch quota (based on current regulation limit for cod as maximum increase): beneficial for predominantly 100mm vessels, not worthwhile for 80mm vessels.
2. Low increase (~10%, based on 100mm discard rates) for all vessels: predominantly 100mm vessels may be interested, not worthwhile for 80mm vessels.
3. High increase (>30%, based on 80mm discard rates): beneficial for more vessels, potentially lead to an increase in F.
4. Low increase for predominantly 100mm vessels and high increase for 80mm vessels. May be perceived as unfair or less of an incentive for 100mm vessels, but in absolute terms could mean a greater increase in quota if they already have higher quotas.

Because there are very few exclusively 100mm vessels in the Dutch fleet, the increase in catch quota incentive could be based on the 80mm discard rates. Those already fishing 100mm will see greater benefits, but the overall impact on fishing mortality is limited. But if no 80mm vessels are willing to participate, giving a large incentive to 100mm vessels only will likely increase F. But if some 80mm vessels participate, overall, F should not increase. Fortunately, the current situation with regards to plaice F is that it needs to be increased to reach the management plan target. So in the short term, an increase in overall F is not a bad result for the stock, but for the long term prospects of FDF, the failure of a FDF to reduce F would be a bad result (i.e. the incentive to reduce discards does not reduce F).

Discards proportions of sole cover a much smaller range, with a maximum of 35% (Figure 4). Therefore an increase in quota of 35% would be an incentive to every vessel in the fishery. A lower increase of 10% would still represent an incentive to almost 60% of the vessels.

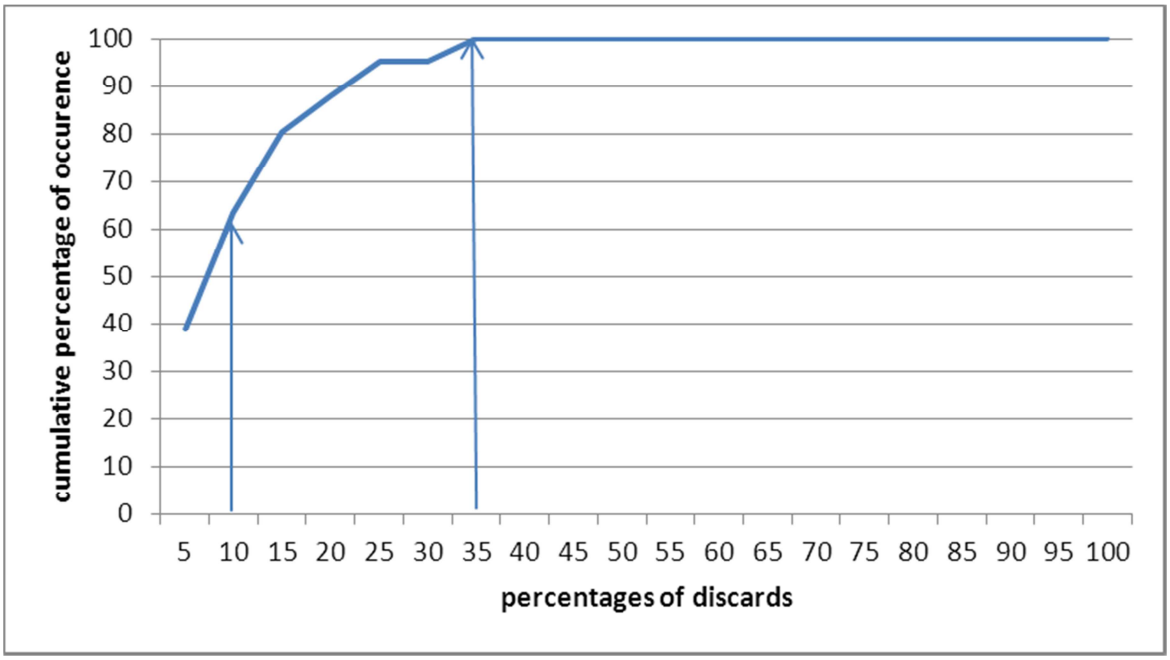

FIGURE 4. CUMULATIVE DISTRIBUTION OF THE PERCENTAGE OF SOLE DISCARDS FROM VESSELS PARTICIPATING IN THE NORTH SEA FLATFISH OVER THE YEARS 2005 TO 2009 (HELMOND AND OVERZEE, 2010)

It seems there are three options to consider in terms of catch quota incentives for sole:

1. 30% increase in catch quota (based on current regulation limit for cod as maximum increase): beneficial to almost all vessels, but very likely to increase overall F.
2. Medium increase (~5%) for all vessels: most may be interested, though this would depend on the fishers ability to lower the proportion of undersized fish in their catch. This may also potentially lead to an increase in F.
3. Low increase (~2.5%): beneficial to fewer vessels, but still an adequate amount for a pilot study. Less likely to increase overall F.

Step 3: Experimental design

The experimental design involves determining what data is available, what data needs to be recorded and how these data will be used to evaluate the various components of the pilot project.

It may be necessary to collect data from some control vessels not participating in the FDF or CQM. Discard rates from these vessels can be compared with participating vessels.

It may be interesting to observe tactical considerations made by fishers in their attempts to reduce discard rates.

Step 4: Implementation of the pilot

Details to be determined following the success of previous steps.

Step 5: Evaluation of results

The evaluation of results would depend on the specific questions/aims of the project. Four main questions would be:

1. Documenting. What is the effectiveness of the FDF in estimating catch levels?
2. Fishery. What is the ability of vessels to reduce discard rates, how, and by how much? Could a Kenniskring be set up to assist fishers in this regard by disseminating information? This could also involve a GIS study of fishing behaviour – e.g. which fishing grounds visited before/after the FDF?
3. Stock. What is the likely impact on the stock? e.g. change in F, change in age structure/selectivity etc.
4. What is the likely long term impact of a fleet-wide implementation of FDF/CQM? Can it be implemented based on the results we have found from the pilot. This would involve some modelling work using the data obtained from the pilot study.

7. Conclusions

The pilot in the first instance should evaluate if plaice and sole discarding can effectively be estimated from video footage on board beam trawlers. This may require testing different set-ups for the camera system.

The next steps aim to ascertain whether a fully documented fishery can effectively allow CQM in the Dutch flatfish fishery, and be embedded in the current management system.

An additional aim could be to determine whether or not discard rates can be effectively reduced through fishing behaviour and patterns. i.e. can a FDF both provide extra landings for fishers and reduced discards and therefore reduced pressure on the stock?

There is a balance between giving sufficient additional quota to ensure attraction of willing participants, and giving appropriately low additional quota to not increase total F. The figures in this document may be of help in making this choice, but the assumptions made and the low sample size should be kept in mind.

8. Quality assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 57846-2009-AQ-NLD-RvA). This certificate is valid until 15 December 2012. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2013 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

9. References

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Justification

Rapport C178/10
Project Number: 4308101014

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

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Date: 29 December 2010

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