



Marine Management Organisation

North Sea Cod Catch Quota Trials: Final Report 2013

August 2014





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the Marine Management Organisation

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Executive summary

- The Marine Management Organisation (MMO) continued with trials of catch quota management for North Sea cod in 2013. 11 trawlers and 1 gill netter participated.
- Vessels taking part were awarded additional quota for North Sea cod and had an obligation to land and count all catches of cod against quota.
- Vessels were fitted with electronic monitoring systems with CCTV to allow the landing obligation to be monitored.
- Results show an overall estimated discard rate of North Sea cod of 0.03% (496kg) from a total sampled catch of 1452 tonnes.
- Self reported landings of unmarketable North Sea cod (both damaged and undersized) were 15.9 tonnes, equivalent to 1.1%.
- Analysis of EM data and CCTV footage was carried out for 11% of hauls for trawlers and 15% of 24 hour hauling cycles for gill netters.
- Results show consistent compliance with the obligation to land all catches of cod and low levels of unmarketable cod catch.
- As a result of 2012 EU/Norway negotiations, the trials remained single-species. The MMO considers that future trials need to take a more holistic approach in the context of mixed fisheries in the North Sea.
- Length frequency data for haddock was collected to determine if species other than cod could be quantified and to see if collecting this biological data was possible. The new in-built measuring tool proved successful and was an improvement on using onscreen virtual callipers but it was still time consuming. More trials need to be carried out with control data to ensure the accuracy of the tool and more information is required to determine what level of sampling is acceptable, to help reduce time and cost spent collecting the length data.
- The scoring and audit system was progressed this year to allow each trip to be assessed for data integrity and the crew's adherence to the duty of care of the REM system. This scoring system has potential to be further developed to ensure consistency in approach.

Introduction

12 English administered fishing vessels took part in catch quota trials for cod in the North Sea during 2013. Additional North Sea cod quota was allocated on the basis of 2011 discard rates evaluated by STECF.

The terms and conditions of the trial remain the same as for 2012 and are based on the regulatory requirements stipulated in Council Regulation 40/2013 setting out opportunities for stocks subject to international negotiations. Specifically, vessels taking part in fully documented fisheries can be allocated additional quota for cod provided all catches are retained, landed and counted against quota. Vessels must be equipped with electronic monitoring equipment incorporating CCTV (REM) to allow the landing obligation for cod to be monitored.

The UK negotiated for other North Sea stocks to be made available for catch quota trials in 2013 although no additional opportunities were agreed.

Objectives

1. To analyse 10% of random hauls from EM data and CCTV footage.
2. To monitor the landing obligation by quantifying the levels of discards of North Sea cod (if any) from observed hauls using standard methodology.
3. To verify self-reported data on levels of undersized catch retained on board.
4. To examine the potential to use REM as a means of quantifying discards of other species.
5. To develop a scoring system to evaluate the quality of data integrity provided by each vessel.

Quota management

Participating vessels were awarded additional quota in accordance with Article 6 of Council Regulation (EU) No 40/2013 of 21 January 2013. Table 1 shows individual allocations and the total catch of cod in 2013 whilst they were participating in CQ trials.

A discard rate of 17.5% for vessels using trawls with a codend mesh size of over 100mm (TR1) was used. This was the discard rate in 2011 for UK vessels as evaluated by STECF. A discard rate for the gill net category (GN1) of 4.5% was used; this was based on STECF data evaluated for Danish vessels in the absence of sufficient UK data.

The additional allocation across the England fully documented fleet amounted to 12.8% of the total catch whilst participating in the scheme. This suggests that the fully documented fleet are catching more than their initial allocations and that there is a net influx of quota to this segment.

In the light of the monitoring results provided below it is considered that the total catch to date has been fully accounted for in terms of quota uptake and there has been no additional fishing mortality.

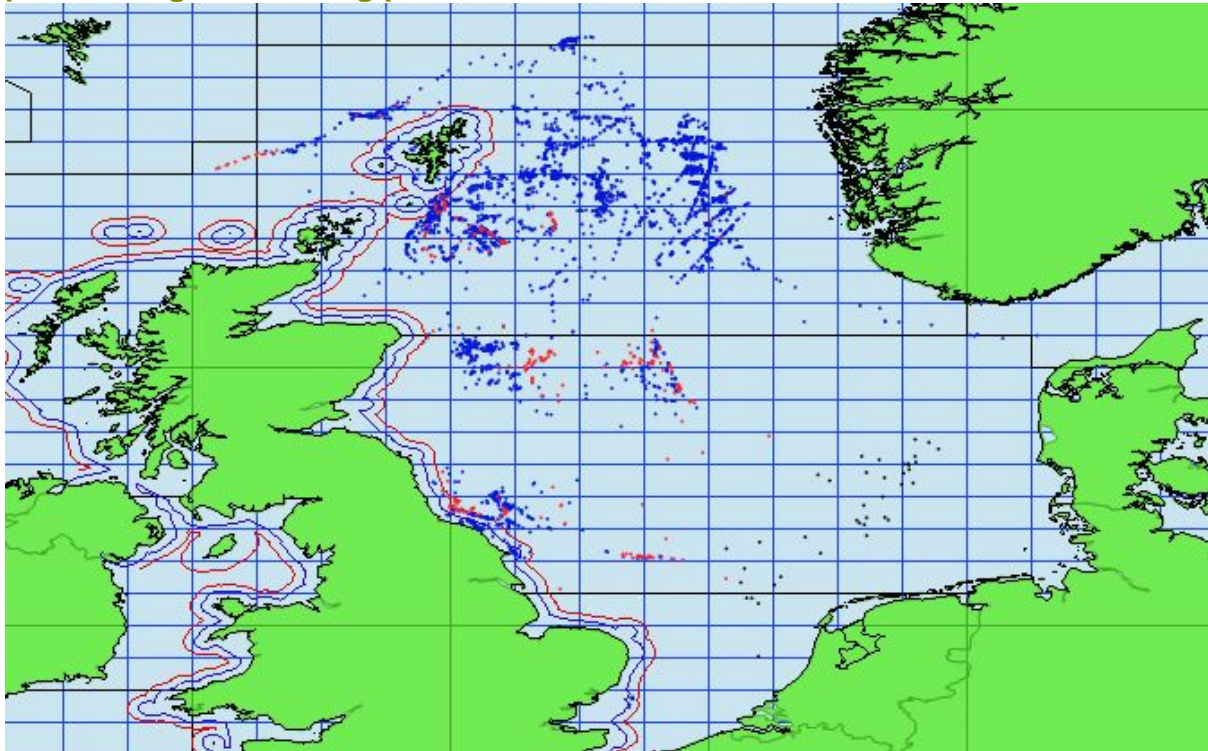
Table 1 Catches of North Sea cod by participant vessels as in 2013 showing additional allocations in tonnes and as percentage of total catch.

Vessel	Vessel category	Total catch in 2013 whilst on the CQ scheme (Tonnes)	Additional allocation (Tonnes)	Additional allocation as percentage of total catch
1	TR1	118.3	14.1	11.9
2	TR1	86.6	13.5	15.6
3	TR1	201.4	39.5	19.6
4	TR1	100.4	23.4	23.3
5	TR1	177.6	17.1	9.6
6	TR1	49.9	9.4	18.8
7	TR1	88.2	0	0.0
8	GN1	18.5	3.4	18.4
9	TR1	193.1	26	13.5
10	TR1	114.6	11.3	9.9
11	TR1	157.8	14.2	9.0
12	TR1	145.4	13.9	9.6
Totals		1451.8	185.8	12.8

Fishing activity

Participant trawlers have engaged in targeted cod, saithe and haddock fisheries in the North Sea with codend mesh sizes of $\geq 120\text{mm}$ and mixed demersal fisheries with codend mesh sizes of $< 120\text{mm}$. Figure 1 shows the spatial distribution of fishing activity with haul positions as identified and recorded by the onboard REM systems and on-shore observers. The gillnet fishing activity is also shown.

Figure 1: Spatial distribution of hauls fished by the North Sea catch quota fleet. Red points are <120mm trawl, blue points are >=120mm trawl, and black points are gillnet fishing positions.



Methodology

As with previous trials, participant vessels are equipped with REM systems supplied by Archipelago Marine Research Ltd. (AMR). The REM system fulfils the requirements of Article 6 of Council Regulation (EU) 40/2013 to allow the catch handling and sorting to be monitored. Sensor (winch rotation, hydraulic pressure, GPS) data and video data are stored on a removable hard drive for retrospective analysis by on-shore observers.

Analysis of EM data is carried out on a random basis with a target level of analysis of 10% of fishing operations. On-shore observers review the data and monitor footage using AMR software to quantify the levels of cod discards and retained undersized or damaged cod.

For the purpose of estimating the quantity of cod that is returned to the sea contrary to terms of the scheme, any cod seen to be discarded are assumed to be just below minimum size of 35cm and a standard weight conversion is used, ($\text{weight} = a \cdot L^b$, where $a=0.0102164$, $L=34\text{cm}$ and $b=3$ for North sea cod quarter 1) to estimate total discards. Nominal weight applied to undersize cod = 0.35kg.

Note: Factor a relates to fish condition and varies by quarter.

Results

Sampling levels

Table 2 shows the amount of fishing effort that has been sampled in 2013.

Approximately 11% of all hauls or 24 hour cycles from 342 trips have been reviewed by on-shore observers. 10 of the 124 fishing trips completed have been unusable, resulting in 89 hauls (2.2%) not being analysed.

Very little gillnet effort has occurred in 2013 (10 valid fishing trips) as the vessel has been undertaking a significant amount of non-fishing activity; 6 of the 40 days fishing (15%) were sampled.

Table 2: The number of trips and hauls fished by participant vessels where data has been returned and analysed. Also shown are trips where data could not be used.

Gear type	Number of trips	Number of hauls fished	Number of hauls sampled	Percentage of hauls analysed	Valid and useable fishing trip?
Valid trips					
Otter/Pair trawl <120mm	67	1022	115	11.3	Yes
Otter/Pair trawl >=120mm	255	2971	325	10.9	Yes
Gillnet	10	40	6	15.0	Yes
Total Sampled	332	4033	446	11.1	Yes
Invalid trips					
Otter/Pair trawl <120mm	1	6	0	0	No
Otter/Pair trawl >=120mm	9	83	0	0	No
Total unsampled	10	89	0	0	No
Total					
Total CQ fleet fishing effort	342	4122	446	10.8	

Observed discards

Observers randomly selected hauls for analysis. 2.6 kg of cod was observed being discarded at sea in the <120mm trawl fishery. When raised to CQ fleet effort using the ratio between valid fished hauls and sampled hauls, this equates to 23.1kg from 1022 hauls. In the >=120mm trawl fishery the amount observed was higher at 51.8kg from 325 observed hauls, which when raised equated to 473.1kg from 2971 valid

hauls. These quantities are both extremely low and indicate that the fishers did not deliberately discard cod or attempt to break this part of the terms and conditions of the scheme. No cod were observed being discarded from the 6 days fishing randomly sampled in the gillnet fishery.

Table 3: Weight of discarded cod observed

Gear type	Number of hauls fished	Number of hauls sampled	Quantity observed on sampled hauls (kg)	Raising factor*	Raised weight observed (kg)
Otter/Pair trawl <120mm	1022	115	2.6	8.9	23.1
Otter/Pair trawl >=120mm	2971	325	51.8	9.1	473.1
Gillnet**	40	6	0.0	6.7	0.0
Total	4033	446	54.4		496.2

*raising factor calculated by Hauls fished / Hauls sampled. **Days fishing (a cycle of nets), not hauls.

Undersized and damaged catch

On-shore observers observed 378.2kg of undersize or damaged cod in the <120mm trawl fishery on 115 randomly selected sampled hauls which when raised by effort (hauls fished/hauls sampled) equated to 3361kg of cod for the 1022 hauls fished. In the >=120mm trawl fishery 1405.6kg of undersize or damaged cod was observed on 325 sampled hauls. When raised by effort to the 2971 valid fishing hauls completed, this equated to 12,849kg of undersize or damaged cod caught by this gear group. In the gillnet fishery, 21kg undersize or damaged cod were observed being caught on 6 sampled days, which gave 140kg of undersize/damaged cod when raised to the 40 days fished. This is shown in Table 4.

Table 4: Weight of undersized or damaged cod observed

Gear type	Number of hauls fished	Number of hauls sampled	Quantity observed on sampled hauls (kg)	Raising factor*	Raised weight observed (kg)
Otter/Pair trawl <120mm	1022	115	378.2	8.9	3361
Otter/Pair trawl >=120mm	2971	325	1405.6	9.1	12849
Gillnet**	40	6	21.0	6.7	140
Total	4033	446	1804.7		16350

*raising factor calculated by Hauls fished / Hauls sampled. **Days fishing (a cycle of nets), not hauls.

Observed undersized and discards as a proportion of total catch

The percentage discard rates and the percentage of undersize/damaged cod caught and retained are shown in Table 5. The table shows the quantities of undersized and damaged cod reported by the Master as well as the on-shore observer estimates raised to trips level from the randomly selected hauls/days sampled.

The discard rates for both the <120mm trawl and the \geq 120mm trawl fleets are virtually zero at less than 0.04%. The undersize/damaged retained quantities are also low with a catch rate of 3% in the <120mm trawl fishery and 1% in the \geq 120mm trawl fishery being observed when the CCTV footage was reviewed. It should be noted that the <120mm trawl fishery generally targets flatfish in the summer months in the central to southern North Sea and *Nephrops* in the central to northern North Sea. This shows that the smaller codend mesh size retains proportionately more undersize fish than the \geq 120mm codend, as one would expect. In addition the \geq 120mm codend fishery usually operates further offshore and in deeper waters than the <120mm codend fishery and therefore may not encounter the smaller cod associated with inshore grounds.

In the gillnet fishery the discard rate was 0% and the undersized or damaged cod catch rate observed was estimated at 140kg, compared to 200kg (1% of catch) reported by the Master. The majority of the cod classified as undersize or damaged are in fact damaged fish above the MLS in the gill net fishery due to the gear's high degree of selectivity for large cod. In summer the cod caught in gillnets can spoil or be eaten by lice if the nets are left fishing for too long. This damage is greatly increased in the summer months due to an increase in water temperature and abundance of sea lice.

Where there was higher fishing effort (2971 hauls) and correspondingly high number of hauls sampled (325) in the \geq 120mm otter trawl fishery, the raised weight estimate observed by the on-shore observer and the weight declared by the Master, were almost identical at 1%, with only 62kg difference over an estimate of nearly 13 tonnes. Overall the on-shore observer estimated the undersize/damaged cod, 0.5% less than that reported by the Master. Obviously both are estimates and not exact weights and therefore we cannot say who is closer to the true weight, but it is encouraging to obtain such similar results.

Table 5: Discard rate and undersize catch rate from analysed data

Gear type	Total catch (kg)	Raised discard quantity (kg)	Discard rate (%)	Raised observed undersized or damaged quantity		Declared undersized or damaged quantity	
				(kg)	(%)	(kg)	(%)
Otter/Pair trawl <120mm	11117 2	23.1	0.02	3361	3.0	2826	2.5
Otter/Pair trawl >=120mm	13221 30	473.1	0.04	12849	1.0	12911	1.0
Gillnet	18464	0	0	140	0.8	200	1.1
Total	14517 66	496.2	0.03	16349	1.1	15937	1.1

System functionality

Table 6 below summarises system faults that were recorded in 2013 in the North Sea catch quota fleet.

Table 6: Summary of EM system faults that have been recorded at the interim stage of 2013 in the North Sea

Control box failures	Camera failures	Rotation sensor failures	Pressure sensor /GPS failures	Lost fishing days	Man hours to rectify (inc. travel)
4*	8	3	nil	0	27

*Of the 4 'control box faults' documented above, 2 were the result of camera short-circuits which rendered the control boxes inoperable until the cameras were repaired. The other 2 instances (both on same vessel) of control box failure were due to inadequate ventilation which caused the units to overheat and cease operating. A ventilation grid has subsequently been installed to allow better airflow around control box.

Collection of length frequency data

During 2012 various methods were used to quantify retained catch. These included the use of digital measuring software to obtain length frequency of retained cod catch to compare with the landed size distribution or to convert to weight. As part of the 2013 trials an additional objective was to examine the potential to quantify discards of other species by number and length.

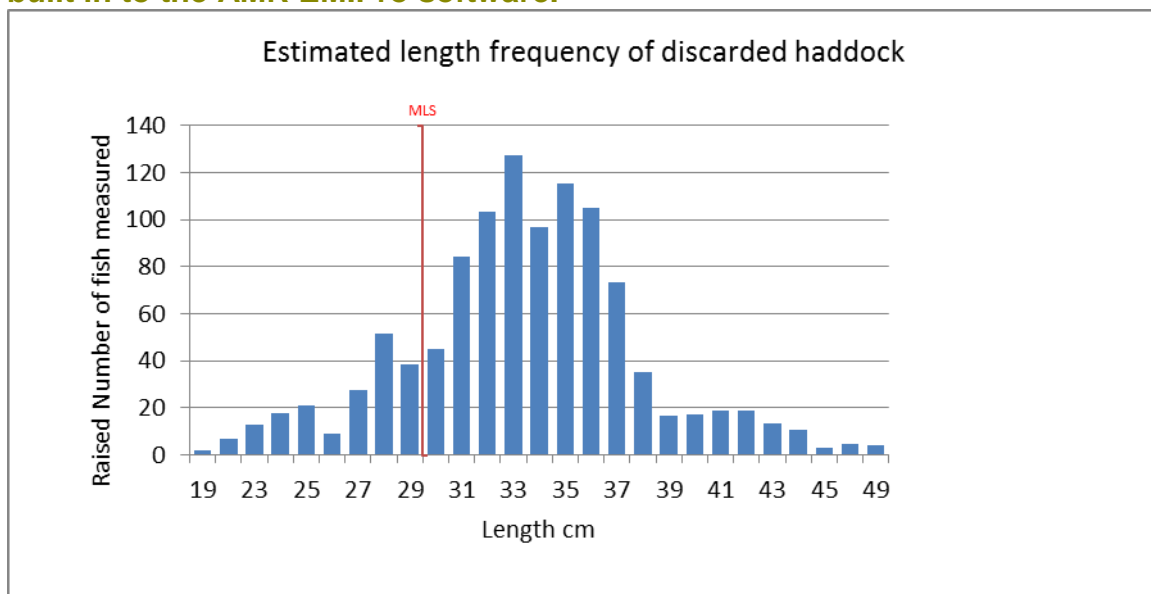
The REM software was upgraded during 2013 to include an internal tool which allows on-shore observers to measure and record fish lengths. Prior to this new development, additional software from other providers had been trialled. This usually took the form of virtual on-screen callipers, but this was found to be time consuming and cumbersome to use in the absence of an integrated data recording function. The new EM software is more user-friendly and reduces the time it takes to measure and

record fish lengths. It should be noted though that successful measurement depends on a number of factors, including fish orientation and presentation relative to camera, camera position, angle and distance from measuring area and accuracy of calibration measurements.

In 2013, one trip was analysed for length frequency of haddock using the AMR in-built measuring tool. The lengths were obtained as the discarded haddock travelled along the conveyor and just prior to them falling down the discard chute. It was not possible to measure every discarded haddock due to the way in which they were presented to the camera, so as many lengths as possible were taken on each haul and raised to the total for the haul using the ratio between measured and total count discarded.

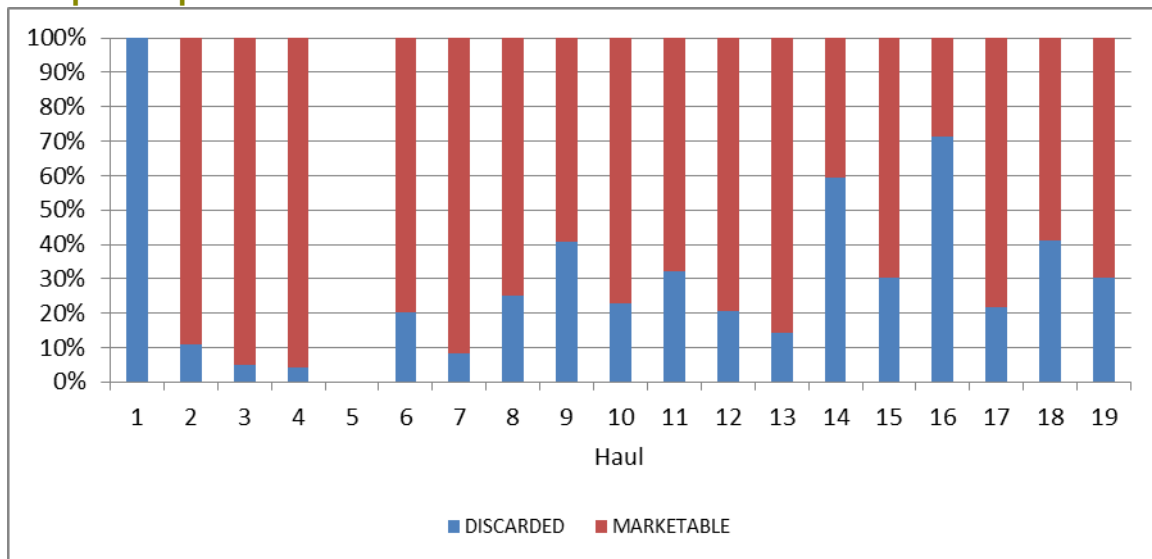
Figure 2 shows the raised length frequency data obtained for the trip by summing the raised numbers for each haul. It can be seen that haddock were discarded up to a length of 49cm, but with the majority being between 31-37cm. It should be noted that the minimum landing size (MLS) of haddock is 30cm and therefore the majority (83%) of haddock discarded were greater than the MLS.

Figure 2: Length frequency of haddock measured using the measuring tool built in to the AMR EMIPro software.



In addition to collecting length data, the analyst also estimated the weights of haddock retained on each haul. By converting the length data of discarded haddock to weight using a length weight relationship ($\text{weight} = a \cdot L^b$, where $a=0.008928$, L = length cm and $b=3$ for North sea haddock quarter 2), the discard rate by weight for each haul, and therefore the trip, could be calculated.

Figure 3: Percentage discard rate of haddock for each haul on the length sampled trip



In total 1668kg of haddock were estimated to have been caught on this trip with 379kg estimated as discarded, giving an overall trip discard rate of approximately 23%. On haul 1 where there was a 100% discard rate, only 10 haddock (all below 41cm) were caught of which only 1 was below the MLS and this low catch rate is likely to be why all were discarded. No haddock were caught on haul 5.

To determine the accuracy of the length frequency estimates it is necessary to have control data to undertake a comparison. Unfortunately it was not possible to send an MMO observer on this sea trip and it was not sampled by Cefas staff as part of their routine Data Collection Framework (DCF) observer programme, therefore no control data exists. The only comparison that can be made is between the estimate of marketable haddock caught on the trip and the haddock actually landed for the trip, but this will not be able to assess the length estimates made.

The total time taken for the shore based observer to make the length estimates for this trip was 29.4 hours.

Audit scoring and data integrity

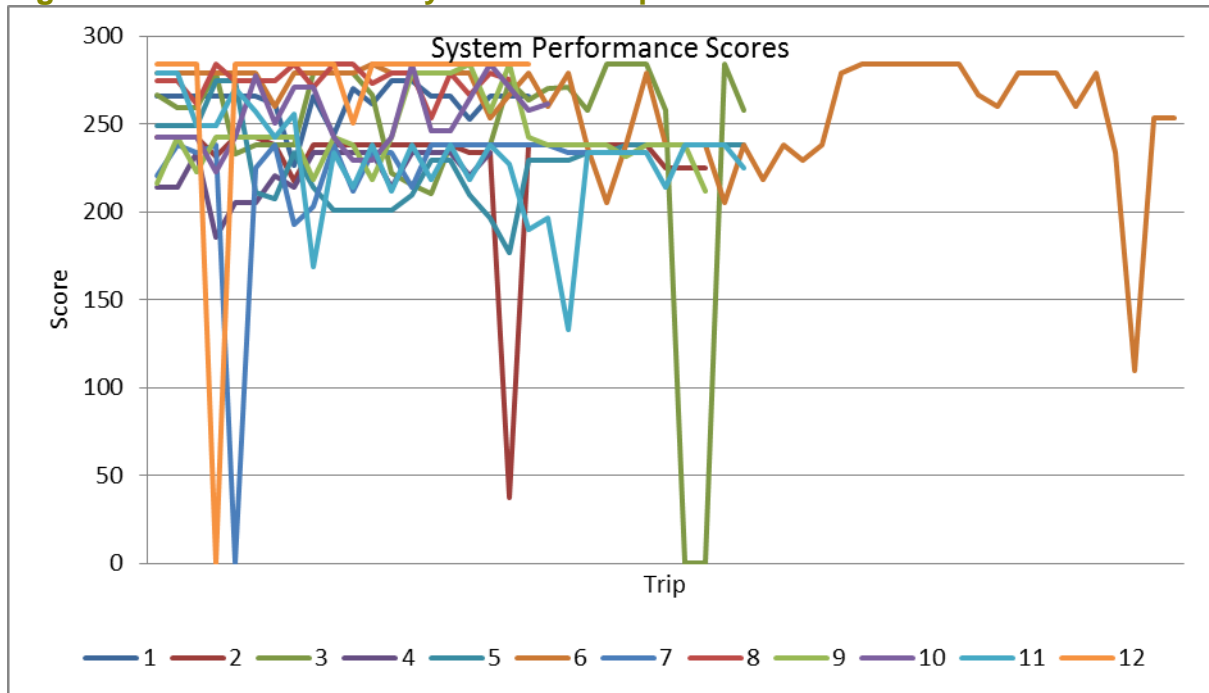
A low level of data loss (42 fishing hauls, approximately 1%) was experienced as a result of system failure. There has been some variance in the quality of imagery and catch recording although this did not compromise the ability of on-shore observers to ensure the duty of care of the system is adhered to and to monitor for discards. Nevertheless it is considered that the quality and integrity of data should always be carefully and consistently monitored to ensure sufficient standards are maintained.

A key factor in maintaining confidence in fully documented fisheries is to ensure the integrity of data collected both in terms of quality and coverage. A scoring system framework has been developed to measure the degree of data integrity and to feed back any shortcomings to the vessel operator.

The system was introduced in May 2013 with a view to a first stage audit to measure any gaps in video and sensor data, submission of catch records and performance of

function tests. This stage 1 scoring is carried out upon receipt of the data hard drive. A second stage score is then applied by the on-shore observer to measure the accuracy of self reported data, catch handling requirements and image quality. The system and the crew's performance were assessed to determine where the improvements are required. Figure 4 shows the score associated with the performance of the EM system. The audit considers such factors as did the GPS and on board sensors function for the trip, were cameras well focussed and function correctly, did the control box work for the entire trip, and were there any video gaps or corrupt files (see Annex 1 for the full list and assessment guide).

Figure 4: Audit scores for system related performance



Generally all vessels scored between 200 and 275 when their REM systems were audited. However Figure 2 shows that there are several trips where the performance score for the system on a trip can drop significantly, sometimes to 0. This is usually related to a complete control box failure, which may be caused by power failures, a camera short circuit or a hard drive failure. Trips where the scores have dropped low but not to zero usually indicate that a rotation or hydraulic sensor, or perhaps a single camera, have malfunctioned. By auditing the system in this way it was possible to identify equipment failures and issues immediately on receipt of the hard drives. This then allowed the auditor to arrange for repairs of the system prior to the vessel sailing again. Vessel 9 provides an example of where the system was unable to be repaired before the vessel sailed again and therefore scored 2 consecutive zero values because of this.

The crew's performance was also assessed by using a scoring system (Figure 5). This was undertaken to allow MMO to identify those vessels where crews were not adhering to the agreed terms of the project and to allow any issues to be addressed as soon as possible.

Figure 5: Audit scores for crew related performance

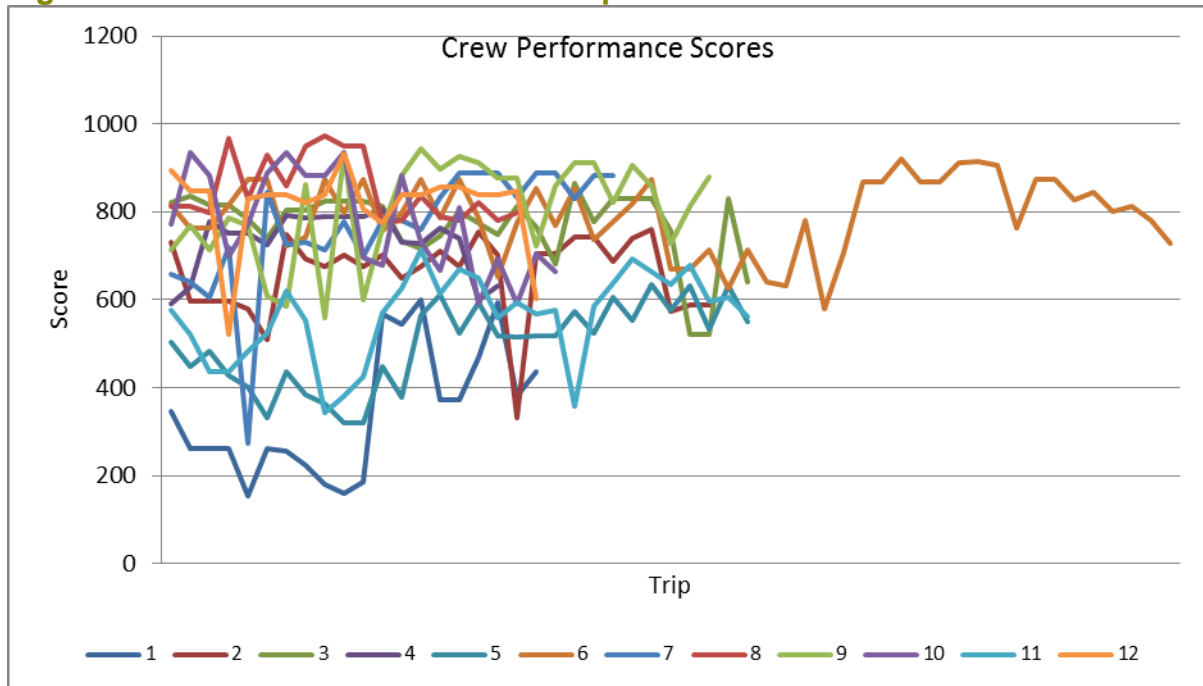
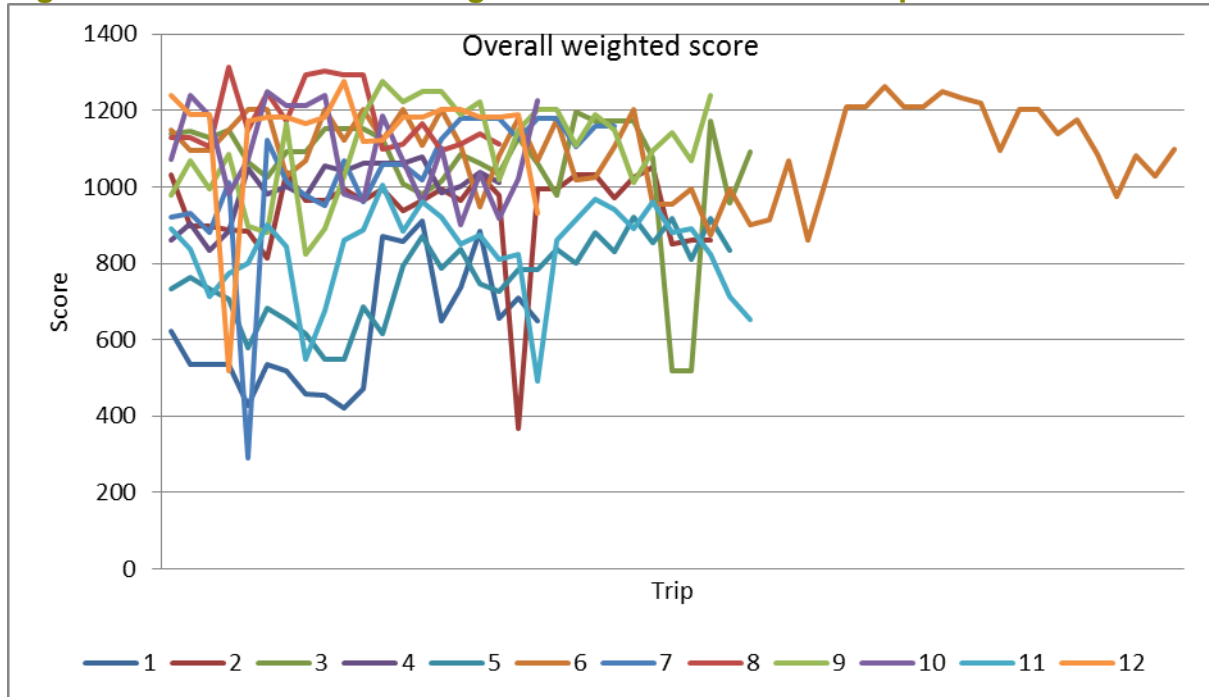


Figure 3 shows that there are some vessels that perform at a higher level than others. Vessel 10 starts off as one of the higher performing vessels in the trial but the performance starts to become inconsistent as the trial continues, whereas Vessel 1 is originally the poorest performer but improves as the trial continues. Most of the vessels continuously score above 600, with the exception of Vessels 1, 5 and 11, although all 3 show an improvement by the end of the trial.

In addition to showing crew performance and system performance separately in this way, a weighted system was developed in 2013 to allow a single score to be calculated that tried to factor in the importance and severity to the project of any failures, either by the crew or the system.

When an issue or failure was noted during an audit, that function was given a score based on the guidance provided in Annex 1. However it was apparent that some failures were more important than others. For example, if the GPS failed to work it would be impossible to determine where the vessel was fishing, but if the rotation sensor failed to work on a trip, the hydraulic sensor was often there to identify when a vessel hauled and shot the net. To try and determine overall impact on confidence in full catch documentation, weighting of scores (see Annex 1) were assigned based on the perceived severity and impact of each of the failures/issues evaluated. The results of this are shown in Figure 6.

Figure 6: The audit scores weighted to show the overall importance of a failure



The similarities between Figure 6 and Figures 4 and 5 can be identified for certain vessels. The poor crew performance is still obvious for vessels 1, 5 and 11, as are the extreme system failures experienced by vessels 2, 3, and 7. More importantly though is that the system failures can clearly be seen as an unusual event for these vessels, whereas the 3 poor performing vessels have consistently low (although improving) scores.

It should be noted that this is a first attempt at establishing an audit and scoring system, mainly to allow the highlighting of issues and the rapid implementation and tracking of remedial action. This area still needs further refinement and is intended as a 'straw man' baseline for discussion on operational implementation.

Discussion

Catches of cod by the English North Sea CQ fleet have increased in comparison to 2012 with less time being devoted to non-fishing activity such as cable guard work. Despite higher catches the results show compliance with the landing obligation for North Sea cod. The methodology used to monitor the landing obligation has remained the same as that for 2011 and 2012 with an analysis target of 10% of random hauls. Any observed discarded cod have been assumed to be just below the minimum size of 35 cm and a corresponding length to weight ratio applied which may give rise to an overestimate of the true discard level as some discards are smaller than 35cm. If an obviously large and damaged or infested cod has been discarded to avoid cross-contamination of retained fish, then an estimate of the weight has been made by eye. The very low rates of discards observed have not necessitated any enforcement action.

Although continued compliance with the landing obligation for cod has been observed this remains a single species catch quota program and it has not been possible to assess the impact of a landing obligation across a mixed range of

species. Although at the interim stage of the project the participants agreed in principle to self report discards of other species, this intention was not followed through. This was because owners considered that additional crew would be required to carry out the additional sorting during the catch processing operation. There was also very little additional incentive available to the owners to offset the cost of this perceived additional crew requirement.

The new built in length measuring tool has allowed the observer to make fish length estimates based on reference lengths taken aboard the vessel. It was not possible to assess the accuracy of these data because no control data from sea going observers was available for comparison. The shore based observer made 354 physical length measurements and made 15 retained haddock weight estimates during this exercise. This took 29.4 hours to complete. If an observer had been sent to sea to collect similar data they would have been committed to the full 8 day trip and expected to work 12 hours per day, to give a total of 96 hours. However the observer would have been able to collect data for all species and both retained and discarded fish. For the measuring tool to be useful it needs to be used in a way that makes economic and with the potential to generate more resolution than relying solely on low sample rates collected at sea. Therefore work needs to be carried out that can provide guidelines into how many length measurements of a particular species are required to provide a suitable subsample and length frequency. For example a 20% haul sample rate would cut total analysis for one species down to under 6 hours for one species and multiple species sampling would collect more measurements per hour of analysis as much of the initial processes would not have to be duplicated. In addition, the shore collected length estimates need to be compared against control data collected at sea for the same fish. It should also be remembered that the cost of time is not the only factor to consider here. The safety of staff undertaking sea trips is important and ensuring they are properly trained and equipped is an additional cost that is not incurred by a shore based observer. If the length measurements taken by the shore based observer prove to be accurate, this will be a very useful tool for gathering biological data in the future.

The new two-part audit and scoring system developed this year, has allowed us to identify and document any issues related to poor crew performance or a system component failure. The audits were carried out within 2 days of the vessel submitting a hard drive and data sheets and allowed the auditors to carry out repairs or discuss performance issues with the Masters, before the vessel sailed again. This meant that the issue only impacted on one hard drive's worth of data at the most and usually only one trip. It also allowed an audit trail for actions with deadlines to be established for MMO staff. The contact with participants also increased and vessels became more involved in and aware of the trial simply because they could see that MMO were carrying out dedicated audits and reviews, and providing constructive feedback. This has become an important management tool for both participants and audit staff. It is acknowledged though that the scoring system as it currently stands requires remodelling by trained mathematicians to ensure that the outputs are balanced, fair and usable.

Annex 1

Auditor scoring guidance

The table below shows suggested scoring for specific scenarios. Auditors should use their own judgment when scoring trips and may have to interpret the guidance to fit different scenarios. If a vessel was not installed with a rotation or hydraulic sensor, then the maximum score of 5 should be given for that section. Total Auditor Score is the sum of the scores for each section.

SCORE	Skipper Record Keeping	Function Tests	Fault Reporting	Time Gaps	Video Gaps	GPS Data	Rotation Sensor	Hydraulic Sensor	Camera Performance
0	No catch records (paperwork or electronic) submitted with hard-drive	No evidence on hard-drive of function tests being performed for this trip	Fault(s) evident, but CQ team or UKFCC were not notified.	Multiple or large time gaps evident throughout fishing trip making trip invalid	Multiple corrupt or missing video files evident throughout trip leading to an invalid trip.	No GPS signal/positional data present for trip	No rotation sensor data showing on EMIPro	No hydraulic sensor data showing on EMIPro	Most cameras observed to be dirty or un-cleaned on multiple occasions throughout trip.
1	Very few catch records submitted with hard drive (a token gesture by skipper)	A function test was attempted but was aborted before completion	Vessel reported fault at end of hard drive, not trip.	Multiple or large time gaps evident throughout fishing trip but analysis could still be attempted	Significant video corruption evident within fishing activity.	Very little GPS data recorded for trip.	Only minimal and intermittent rotation sensor data present	Only minimal and intermittent hydraulic sensor data present	At least one camera with a critical view observed to be dirty and un-cleaned for multiple occasions throughout trip
2	Some catch records submitted,	Skipper attempted to perform	Vessel reported fault at end	One or two (>2 hours) time gaps	One or two (>2 hours) video	Slight loss of positional	Rotation sensor data	Hydraulic sensor data present for	Reasonable, but no evidence of

	but missing crucial information	function tests on several occasions but didn't successfully complete any	of second trip after a fault occurred	evident within fishing activity which may affect video analysis	corruption evident within fishing activity which may affect video analysis	data (>2hours duration), with some during fishing operations	present for < half the trip.	< half the trip.	cleaning during trip.
3	The majority of catch records submitted but with obvious minor inaccuracies and omissions	Only 1 function test was successfully performed this trip	Vessel notified fault at end of trip.	A small number of short duration (<2minutes) gaps evident within fishing activity, but not affecting data quality greatly.	Limited (<2hours) video corruption outside of fishing activity or <2 minutes during fishing activity	Partial loss of positional data (>2hours).	Rotation sensor data present for majority of trip.	Hydraulic sensor data present for majority of trip.	Occasionally dirty but evidence of some cleaning during trip.
4	All catch records submitted with hard-drive, but with some minor errors or omissions	Vessel has conducted function tests at both start and end of trip but one was not completed correctly	Fault reported by vessel during trip to allow us to mobilise repair team	A small number of short duration (<2minutes) gaps evident outside of fishing activity with no effect on	Minimal video corruption evident (<2minutes) outside of fishing activity with no effect on analysis	Partial loss of positional data (<2 hours) but not during fishing activity, only on steam to or from	Only very slight sensor loss occurred but not during fishing activity	Only very slight sensor loss occurred but not during fishing activity	Very slight picture quality loss due to dirty cameras but crew regularly cleaning cameras

				analysis		fishing grounds.			
5	All catch records (paperwork or electronic) submitted correctly with hard-drive	Vessel has conducted successful function tests at both start and end of trip.	No faults evident on hard-drive, or notification of fault received immediately.	No time gaps affecting fishing trips evident in data set.	No missing or corrupt video files evident.	No GPS issues showing on EMIPro software	Rotation sensor data showing as expected on EMI	Hydraulic sensor data showing as expected on EMI	All cameras appeared to be clean throughout duration of trip.

Analyst scoring guidance

The table below shows suggested scoring for specific scenarios. Analysts should use their own judgement when scoring trips and may have to interpret the guidance to fit different scenarios. Total Analyst Score is the sum of the scores for each section.

SCORE	Crew Behaviour	Image Quality	CQ Discarding	Skipper Records Quality	Salesnote Undersize Recording
0	Crew appear to be deliberately obscuring view(s) of camera(s) during catch handling.	Unusable on at least one camera. Cameras or lenses have either moved, or due to dirt/water etc. do not provide a means of assessing catch of U/S and damaged fish.	Blatant discarding of catch quota species that should be retained, and no attempt to adhere to Catch Quota T&Cs on all hauls	No agreement between skipper's and analyst's estimate on any hauls	No record of undersize/damaged fish being declared to come off quotas after checking of salesnote or other documentation. No attempt to record undersize
1	Crew have altered behaviour since installation and cameras do not see required views	Very Poor. Cameras or lenses have either moved, or due to dirt/water etc. do not provide a means of assessing catch of U/S and damaged fish accurately. An estimate can be made for at least one segment of the catch but not all.	Blatant discarding of a large proportion of catch quota species on majority of hauls. Occasional retention of discards.	Between 25-50% disagreement between skipper's and analyst's estimate on some hauls	Very intermittent and inaccurate recording of undersize/damaged CQ species to come off quota. Salesnote or other documents not routinely or easily available.
2	Crew inadvertently and occasionally obscuring views of cameras and/or regularly not	Poor. Camera angles, lens focus or cleanliness still needs to be improved on docking. Estimates can be made for all	Blatant discarding or suspected discarding of CQ species on a minority of hauls by at least one	Between 10-25% disagreement between skipper's and analyst's estimate on some hauls	The majority of records appear but there is still instances of medium to large quantities of undersize or damaged CQ species not being

	showing undersize to a camera	catch segments but they are not considered accurate or reliable.	crew member. Routine retention of discards by other crew members		recorded properly
3	Crew are generally cooperating with the terms and conditions, although occasionally undersize are not placed under camera prior to stowage in fish room.	Average or medium quality. If cameras had been cleaned, analysis and accuracy would have improved. A very slight adjustment could be made to the focus or angle of cameras to improve the analysis. Estimates can be made for all catch segments and results are usable.	What appears to be unintentional discarding of CQ species but at quite a high level	<10% difference between skipper's and analyst's estimate on some hauls	Some records don't appear on salesnote for small quantities of undersize fish caught.
4	Crew are obviously trying to adhere to the terms and conditions and are trying to show catches to cameras. Very occasionally failing or forgetting when non critical or view of catch not quite perfect	Good quality. All critical cameras clean and perfect views and confident estimates can be made for all catch segments. Very slight impairment of overview or non-critical cameras	Occasional unintentional discarding of CQ species at a very minimal level.	<10% difference between skipper's and analyst's estimate on only one or two hauls.	Entries for all CQ species (undersize and damaged) appear on salesnote or documentation but value is not recorded as zero

5	Crew clearly collect and make the undersize catch and other catches of interest, available to the cameras, before stowing in fish room.	Excellent quality. All cameras clean and focussed on target area throughout analysed haul(s).	No discarding of CQ species evident.	Skipper's estimates agree with an analyst's estimates in all instances throughout trip to within 5%.	Entries for all CQ species (undersize and damaged) appear on salesnote with a zero value recorded.
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	Auditor Categories									Analyst Categories				
Weighting (out of 5)	Skipper Records Submitted	Funtion Tests Performed	Faults Reported	Video Gaps	Time Gaps	GPS Data	Rotation Sensor	Hydraulic Sensor	Camera Cleanliness	Crew Behaviour	Image Quality	CQ Species Discarding	Skipper Record Accuracy	Salesnote/Proof Undersize Accounted
Functionality of System Importance	4	5	5	4	4	5	3	3	4	5	4	2	4	3
Scheme Success Importance	3	3	5	4	4	5	3	3	4	5	4	5	4	4
Severity weighting (T&C complaine out of 20)	20	10	20	5	5	10	5	5	10	15	10	20	5	15
Total Weighting Score	27	18	30	13	13	20	11	11	18	25	18	27	13	22
Vessel responsibility percent	100	100	100	50	50	0	25	0	100	100	25	100	75	100
Equipment responsibility percent	0	0	0	50	50	100	75	100	0	0	75	0	25	0