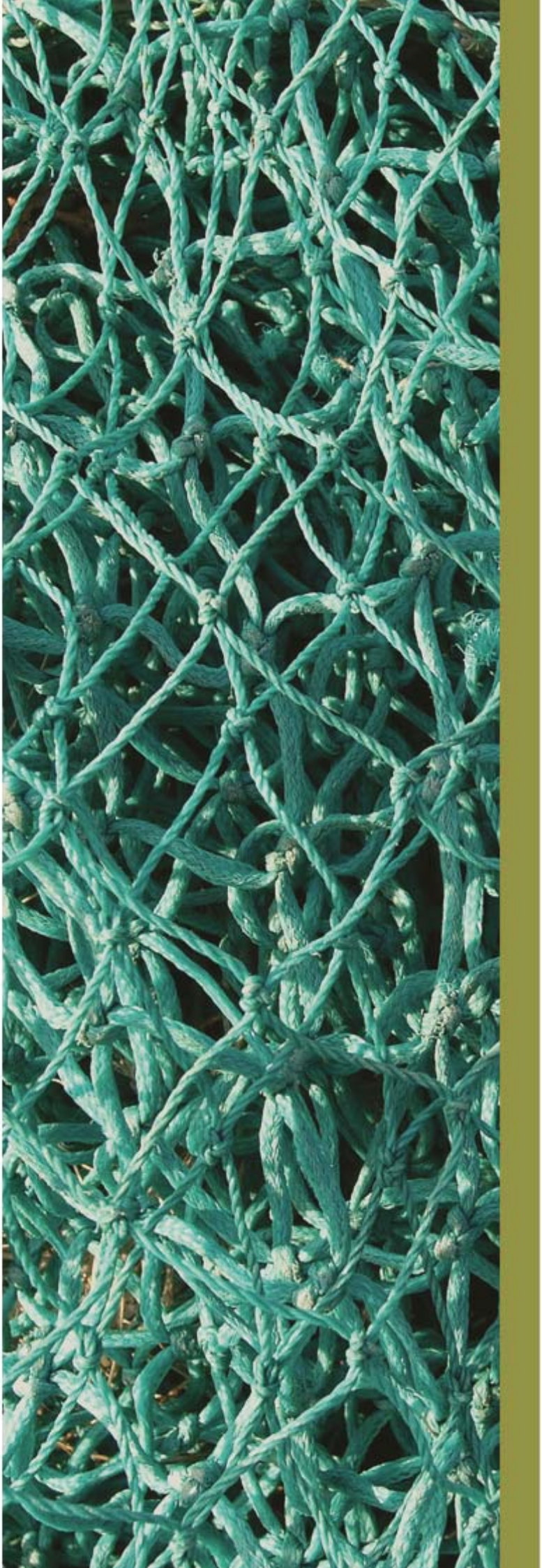
Marine Management Organisation

Under 10 metre remote electronic monitoring technical trial

June 2013



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Executive summary

Two under 10 metre trawlers from Whitehaven were equipped with remote electronic monitoring (REM) equipment as part of a technical trial to test the reliability of this equipment and its usefulness in assessing catches. Sensor data and CCTV footage collected was analysed by a shore-based observer.

The systems proved very reliable on board with sensors working almost continuously.

Power supply issues resulted in some video footage files (approximately 20 hours out of 828 hours, over all three hard drives) being corrupted, but these were recoverable using the appropriate software so that no footage was lost.

Comparing skipper-reported estimates and fishing effort against the REM data showed that the REM data could be used to verify fishing effort and location as reported by the skipper.

Self-reported catch records could also be verified using the video footage and shore based observer estimates of catch for each species.

The shore-based observer's estimates were often in close agreement with the skipper's, demonstrating that it is possible to obtain catch estimates on under 10 metre vessels. These could be further improved by instructing crews to process catches in such a way that would allow the shore based observer a better view.

The less than 10 metre fleet can often be multi-purpose and use different fishing methods between sea trips, such as gill net and then trawl. This makes it challenging to situate the cameras to view all activities. This can be remedied by using a six-camera system, re-situating the cameras for the different activities or asking crew to alter their usual working pattern.

REM systems could be used on the larger greater than 10 metre vessels if there was a reliable power source, good instruction to the crew in catch handling, available superstructure to attach equipment to, and flexibility to move cameras when vessels change between fishing technique.

Purpose

The purpose of the trial was to test the reliability of using REM equipment onboard commercial fishing vessels of less than 10 metres overall length, and to determine whether this technology could be used to monitor and quantify catches.

Methodology

Vessels and equipment

Two vessels operating out of the north western English port of Whitehaven volunteered to participate in these trials – the MFV Bay Venture and MFV Rachel Claire.

Both vessels were installed with the Archipelago Marine Research 4.1 REM system in November 2011. Each system consisted of a 4.1 control box, a GPS system, a winch/drum sensor, a hydraulic oil pressure sensor and four CCTV cameras. Footage and sensor data was collected on 500 GB PATA hard drives, provided to each vessel. When PATA drives were full, they were swapped for new ones and the full drives were transferred to the office for analysis.

Sensor data was analysed to determine the vessels fishing activities and the reliability of the equipment. CCTV cameras were used to corroborate sensor information and provide footage for catch estimation. Catches were viewed to determine how feasible it would be to gather data on the quantities caught and discarded. Catch comparison data was provided through the Centre for Environment, Fisheries and Aquaculture Science (Cefas), who were conducting gear trials with these vessels during the same time frame.

Results

Fishing activity

The sensor data was interpreted to provide the following information.

Bay Venture

The equipment was installed over two days, starting 1 November 2011, with the equipment initialised on 2 November. The vessel used two hard drives and the trial ended on the 22 May 2012. During this time the vessel completed 39 fishing trips and carried out 113 hauls. All trips were otter trawl trips.

The REM equipment also showed that there were periods when the vessel was unable to go to sea and on one occasion this was as long as 7 weeks. This was mainly due to unfavourable weather and tides.

Rachel Claire

The equipment was installed on 28 November over two days and the system was initialised on the 29 November. The vessel only required one hard drive during the period 28 November 2011 to 2 May 2012. The first fishing activity after installation did not occur until 11 January 2012 as the vessel was unable to sail due to unfavourable weather and tides.

The sensors showed that there was no winch activity, which would suggest that the sensor was either broken or the winch was not used. By viewing the footage it could be seen that the vessel was gill netting for cod so did not use the winch and so no winch sensor data was recorded. The first winch activity, and therefore trawling, occurred on the 28 February.

The fishing activity for both vessels is shown in Table 1.

Table 1: Summary of fishing activity as recorded and interpreted from the sensor data

Vessel (hard drive)	Date of initialisation	End date	Number of trips	Number of hauls	Hours fishing
Bay Venture (HD1)	2 November 2011	14 March 2012	22	60	258
Bay Venture (HD2)	17 March 2012	22 May 2012	17	53	279.5
Rachel Claire (HD1 only)	29 November 2011	2 May 2012	22 trawling (5 netting)	51 trawling (0 netting)	290
		Trawling totals	61	164	827.5

REM equipment performance

Bay Venture

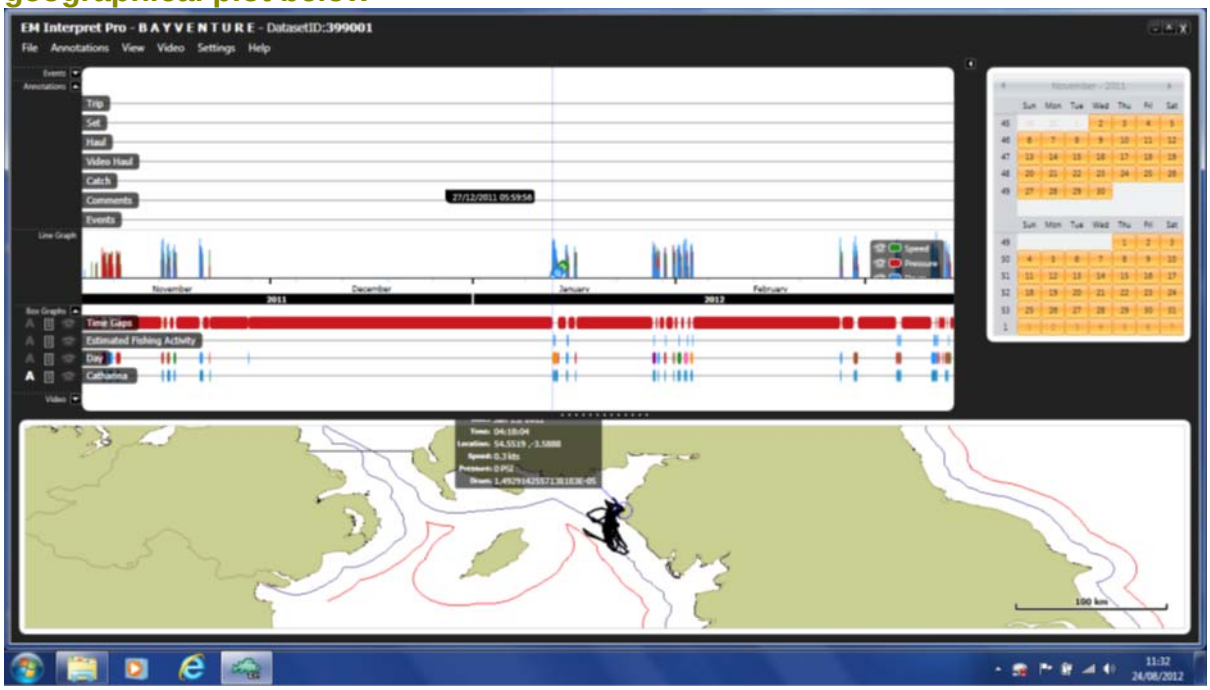
All sensors were working normally when the equipment was installed. The pressure sensor and GPS worked perfectly throughout the trial.

However, the winch rotation sensor failed to work on the first three fishing trips but then functioned normally for all other trips. Discussions with the skipper revealed that the reflectors that were attached to the drum and trigger the sensor had become detached. Bolts on the drum brake rotated so close to the drum that there was not enough clearance for the attached reflectors. The skipper reversed these bolts to allow enough clearance for the reflectors then reattached the reflectors – this allowed the sensor to detect rotation of winches again.

One of the cameras broke down during the trial and was replaced. This was due to an installation error rather than equipment failure, as it was found that the watertight seal on the camera housing unit was not properly situated during installation. This resulted in water ingress and camera failure. Seals should always be double checked to ensure no water can enter the equipment.

The control box functioned well throughout the trial. The sensor data for this whole hard drive for Bay Venture is displayed using the EMI Pro software and this is shown in Figure 1. Note the absence of a blue drum or winch rotation sensor line in the earlier trips.

Figure 1: The sensor data for the first Bay Venture hard drive, with the GPS geographical plot below

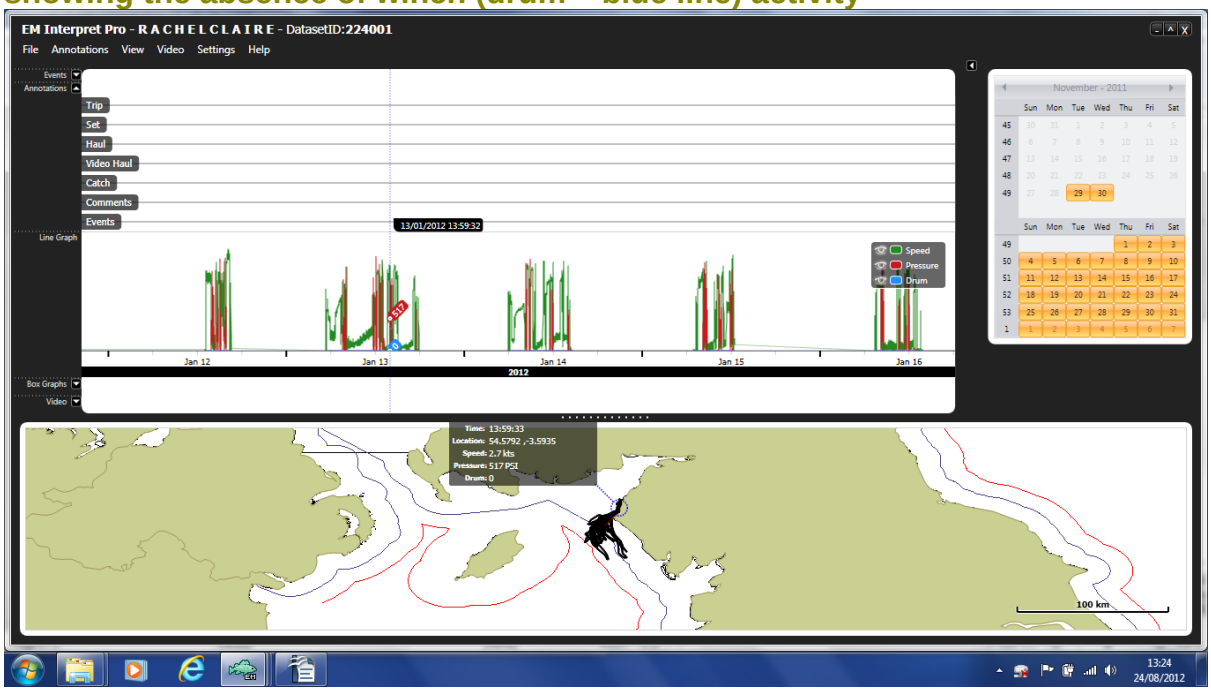


Rachel Claire

All sensors were working normally when the equipment was installed and functioned correctly throughout the trial. Initially it was thought that the winch rotation sensor had failed for the first few trips but it was determined, using the video footage, that the vessel was actually gill netting rather than trawling and therefore did not use the winches. This can be seen in Figure 2 showing the sensor data for a gill net trip. It can be seen that there is no blue line which represents drum or winch rotation.

The control box also functioned correctly throughout the trial. The Rachel Claire only used one hard drive during the trial period.

Figure 2: The sensor data for the gill net trips carried out by the Rachel Claire, showing the absence of winch (drum – blue line) activity



For both vessels for the duration of the trial, the only REM system hardware issue was that the winch sensor did not function on three sea trips on the Bay Venture. The camera issues were installation errors.

Video footage

The sensor data associated with the video footage showed that on several occasions the cameras stopped recording unexpectedly. This resulted in video footage being lost from the hard drives as shown in Table 2.

Table 2: Quantities of video footage of either fishing activity or catch sorting activity lost during the trial

Vessel (hard drive)	Hours fishing	Fishing video footage lost (hours)	Percentage of video footage lost
Bay Venture (HD1)	258	1	0.4
Bay Venture (HD2)	279.5	17.5	6.3
Rachel Claire (HD1 only)	290	2	0.7
Totals	**827.5**	**20.5**	**2.5**

It can be seen that there was significant loss of video footage for the second hard drive used by the Bay Venture. The video loss on the other hard drive and for the Rachel Claire was minimal.

Investigations determined that the Rachel Claire video loss was due to a power failure (a broken battery terminal) while at sea. This corrupted a full video clip file – these are approximately 2 hours long.

A power failure also caused the loss for Bay Venture HD1, although the amount of video lost was less. The significant loss of video in Bay Venture HD2 was initially thought to be caused by other factors, such as the wrong port box being established around Whitehaven. This triggers the vessel's REM system to stop recording once it enters this box. However, investigation of the sensor data established that this was not the case instead proving it was due to power failures.

When the REM is recording video, the video is stored in files approximately 2 hours long. If a power failure occurs while the system is recording video, even if only for a few seconds, it cannot close down the video file correctly and fails to assign a file extension to these video files associated with the time of power failure. This results in the corrupted video files being unable to open using the EMI software in the office, although they are still stored within the hard drives. This will show as a loss of approximately 2 hours video rather than just the few seconds of the power failure.

However, additional software is now available that can locate these corrupted video files and reassign the correct file extension to allow them to be restored to the hard drive and fully useable. This has proved 100 per cent successful and eliminated video loss, but adds an additional time overhead and software costs.

Alternatively, installing an uninterrupted power supply (UPS) between the control box and the power supply would allow the system to continue functioning for power losses up to about 10 minutes and would eradicate or significantly reduce the current quantity of lost video. Costs to install a UPS are minimal (approximately £100). It is also worth noting that the new version 4.5 control boxes have a 7-minute UPS built into them, which would also reduce video loss and allow a six-camera option for further flexibility.

Image quality

The video footage for each hard drive was reviewed to determine whether video collected on under 10 metre vessels could potentially be used to assess catches.

Each vessel had four cameras on board and each camera view was reviewed to evaluate its usefulness and determine whether minor adjustments, such as lens size or camera angle, would allow them to gather the imagery required to fully assess catches and view fisher behaviour.

Bay Venture

- Camera 1 (C1) was set up to view the port side pound in the stern of the vessel.
- Camera 2 (C2) shows an overview of the starboard side of the vessel to look down inside the baskets of retained fish.
- Camera 3 (C3) shows the port side of the vessel and the metal table where the retained fish are gutted.
- Camera 4 (C4) shows the starboard side of the pound at the stern of the vessel.

The two stern cameras (C1 and C4) provide a good view of the pounds and how it is divided in two. They also provide a good view of the net drums and can easily discern when the nets are stored on board on the drum. This provides good information on whether the vessel is fishing or not. When the vessel has hauled the nets on board, the codends can be seen being emptied into the pounds.

The crew can be viewed continuously during the sorting process but it is difficult to see if fish are being discarded through a pound scupper or what species these could be. C1 also looks slightly out of focus or could have encrusted salt on the camera housing, making the picture slightly blurry.

The Bay Venture was undertaking gear trials with Cefas during this time period and the crew were required to basket up the discard portion of the catch. This provided a good opportunity to gather a basket count of discards using the cameras.

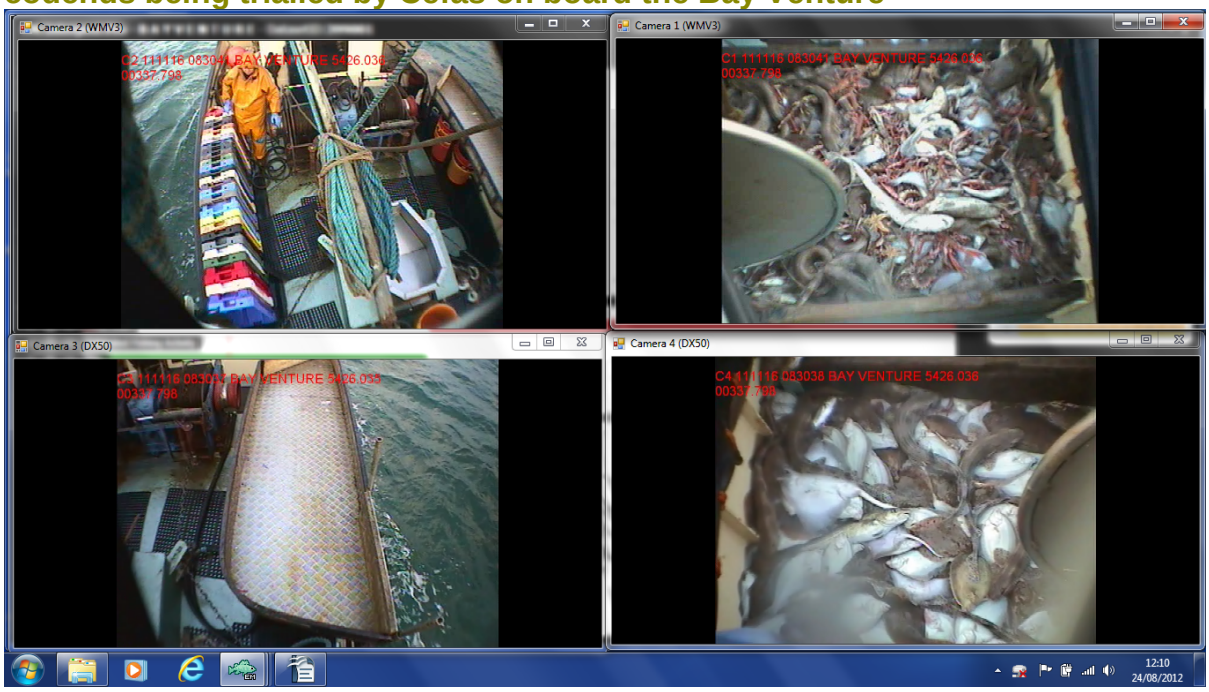
Viewing the processing of the retained fish is excellent and C3 can provide an opportunity for a full individual count of fish during the gutting process. This same camera provides an excellent view of any discarding of undersize or damaged fish identified by the crew at the gutting stage. However, when the retained fish are thrown into baskets it is difficult to get a volume estimate of partially filled baskets or the total baskets of retained catch for the trip.

Some of the night-time imagery was quite grainy due to poor lighting conditions. The fitting of cameras, especially the overview camera was difficult because there was limited overhead superstructure for attaching cameras.

Figure 3 shows the camera views for all four cameras installed on the Bay Venture and the image for C3 clearly shows a crewman discarding a plaice during the gutting process. Figure 4 shows the difference between the catch compositions of the two different codends being trialled by Cefas.

Figure 3: The camera views for the Bay Venture with imagery of discarding during the retained fish processing stage

Figure 4: Clear imagery of different catch compositions from the two different codends being trialled by Cefas on board the Bay Venture



Rachel Claire

- Camera 1 (C1) shows the sorting table where nephrops are separated from retained fish and discards and where gutting and tailing occurs. This is located on the port side of the vessel.
- Camera 2 (C2) shows the area of deck where the retained boxes and baskets of fish are stored after sorting. It looks forward to the edge of the sorting table on the port side of the vessel.

- Camera 3 (C3) looks forward from amidships on the starboard side of the vessel and has a clear view of the gill net hauler.
- Camera 4 (C4) looks down on the stern area of the deck to view the fish pound and trawl gear activity. It is slightly blurry and would benefit from re-focusing.

Trawling activity

C4 gives an excellent view of the stern of the vessel and all trawl activity can be clearly viewed, especially the trawl doors coming in and out. It also affords a clear view of the codends being emptied on board the vessel. A total bulk estimate could be made if required. The crew can clearly be seen shovelling the catch into baskets for processing on the sorting table or removing larger fish into separate baskets. Any discarding by hand can be observed at this stage but speciation would be difficult at this stage except for very large individual fish.

When the basketed catch is sorted on the table all species can clearly be identified and a good count of discarded and retained fish can be made at this stage. During gutting all species can be counted and identified. However, obtaining a volume of discarded and retained fish is not as easy. C2 does give an overview of where the retained catch is stored but it is difficult to see into part filled baskets to obtain volume or weight estimates, unless the baskets are almost full.

There are one or two small areas of deck that are not covered by the cameras but this could be addressed by slight changes in the angles of cameras.

Figure 5 shows the camera views for all four cameras as displayed by EMI Pro software and the crew can be seen tailing nephrops on a sorting table, with catch in the fish pound at the stern of the vessel. The crew also select out fish for retaining at this stage and discard nephrops heads and small unwanted finfish straight through a scupper in the shelter deck at table level.

Figure 5: Rachel Claire camera views with imagery of the crew processing the catch, which was predominantly nephrops

Gill netting

C1 and C2 show the storage of the net bins, pre and post fishing. C4 shows a good view of the nets being shot over the stern of the vessel. The only camera to have a view of the nets being hauled on board is C3 however this is often obscured by the crew who need to stand in the way of the camera to handle the net (see Figure 6). It is possible to count the fish as they come on board from the current view but it is not possible to determine the species or see any drop outs of cetaceans or birds prior to coming on board. A repositioning of this C3 would improve the view of the gill net coming on board.

Figure 6: The camera views for the Rachel Claire when engaged in gill net fishing

This also shows how the crew can unintentionally obscure the camera views when recovering their nets

During the gill netting process the net is flaked between two large containers and this is when the crew usually extract the fish from the net, by hand. C1 and C3 allow this process to be observed, as shown in Figure 7. It is possible to see most of the fish being removed from the nets but again this could be improved with some minor camera adjustments.

Figure 7: The crew extracting a cod from a gill net on board the Rachel Claire, during the flaking process

Once the fishing has completed the crew then gut all the retained fish in clear view of a camera and a very accurate count by species can be obtained as well as an estimate by length if required. However, obtaining an estimate of discarding is not possible for netting as the crew usually throw these straight over the side as soon as extracted.

Viewing of the gill netting activity is difficult and could be greatly improved if cameras were altered when it was known the vessel was using this gear type. However, they can often change gear type at short notice or even daily depending on weather conditions and fish abundance. Having the updated 4.5 unit with an additional two cameras would allow this activity and trawling to be covered at all times.

For both types of activity there are issues with grainy imagery at night due to low light levels but this could easily be improved by installing better lighting. There was also occasional electrical interference to one of the cameras and it was thought this was caused by the skipper operating the VHF radio.

Comparing against self-reported data

When the systems were installed on these vessels the skippers were not required to provide detailed catch records because, firstly, this was a trial to test the equipment's reliability on board and the feasibility of having the REM equipment on board under 10 metre vessels. Secondly, it was understood that both vessels would be collecting data as part of a gear trial being run by Cefas.

The Bay Venture collected this data for 10 trips and although Rachel Claire collected data for 20 days fishing, no data was supplied by Cefas. Therefore, the following section only relates to Bay Venture sea trips between 5 November 2011 and 16th January 2012.

Fishing activity

Sensor-collected data was compared against the fishing effort data supplied by the vessel to Cefas. There was an exact match in date of trip and the number of hauls made during each trip, except that in the first trip (5 November 2011) the skipper only supplied data for four hauls where the sensors indicated that five hauls were made.

The CCTV footage was used to check whether four or five hauls had been fished and it showed that five hauls had been made. This indicated that the skipper had either not recorded or submitted data for one of the hauls or that the data had not been supplied by Cefas. Cefas was contacted and they confirmed that all supplied data had been entered and therefore the skipper had not provided the data for one of the hauls. Discussions with the skipper revealed that they had completed five hauls but had been unable to process the last haul according to Cefas' gear trial because they had to hurry to port so that they could enter the lock gates before the tide receded too far. This practice was agreed with Cefas at the outset of the gear trial project. This demonstrated that the REM equipment is a useful and accurate tool for verifying skippers self-reported fishing activity records and checking all data has been entered.

Catch comparisons

One haul from each of the trips was selected using a random number generator. Each selected haul was given a brief overview review to see if an analyst could gather good catch data from the imagery. On all hauls the analyst stated it was possible to gather data on the retained catches by volume or by counting individuals as they were gutted, although there were some limitations as well as some points of clarity, which are detailed below. Bulk estimates of discard fish was also possible although identifying individual species was not always possible due to the way the catch was sorted.

- Retained lesser spotted dogfish could only be estimated by counting baskets retained because they were landed whole and not gutted. A full basket was light at approximately 10 to 12 kg because the dogfish were always place in baskets alive and very active and therefore baskets could not be packed full because the dogfish would just escape.
- All other retained fish could be identified by species and counted during the gutting process.
- It was impossible to distinguish between plaice and dab discards as they were all shovelled into the same baskets, weights taken and species proportions estimated before thrown overboard. If species were separated into different species then the analyst would have been able to verify species and quantify the discarded portion. However, this would have required considerable additional work by the crew.
- The mixed skate were usually thornback rays with occasional cuckoo ray and it was actually possible to determine the sex of the retained ones whilst they were being gutted, which may have additional scientific applications for sex ratios and distribution patterns.
- Nephrops volumes were for whole nephrops as part of a basket converted to weight, with a full heaped basket weighing approximately 18 kg and a basket filled to just below level of the rim, weighing approximately 15 kg.
- The skipper recorded all gurnards as GUR which is the species code for red gurnard, although the skipper was using GUR in this case to represent mixed gurnard species. However, our imagery shows these were actually grey gurnards, species code GUG.
- Some prime species were not recorded by the skipper on some hauls, such as brill or cod, however because the catches were small quantities Cefas had not requested this level of detail.

Three of the hauls from the original randomly selected hauls were then selected to have full catch comparison analysis using the CCTV footage and compared against the fishers self-reported catches. This was only carried out for three trips because this comparison was only to give an indication of whether or not weight estimation was possible. Also, we were only comparing our results against the skipper's self-reported estimates and this could not be classed as accurate control data, unlike on board observer-collected data.

The first trip on 5 November 2011 was excluded because it was impossible to tell which haul's data had not been submitted on this trip without fully analysing all hauls on this trip. Haul 4 was randomly selected on the third trip that was analysed (eighth fishing trip after installation on 13 January 2012). However, the crew carried out a

short fifth haul and processed the rays that were caught on both hauls as an aggregated haul. Therefore the analyst reviewed both hauls 4 and 5 on this trip and then added the catches together.

Tables 3, 4 and 5 show the results of comparing self-reported skipper's estimates against the REM analyst's estimates for three different hauls. During the review of the video footage the crew could be seen separating the catch into its component species and recording the component weights for each codend used, so that the data could be provided to Cefas for the gear trial experiment. However, although the crew recorded plaice and whiting as separate discard species, the plaice discards could clearly be seen to contain dab and the whiting contained bib and possibly other small round fish discard species. This was in line with Cefas' instructions because to separate to species level in this case would have taken considerable effort.

Instead the crew were to estimate what proportion of these mixed fish were made up of different species and assign them a weight. So where the analyst has quantified plaice discards, the estimate also includes dab. And whiting discards could contain bib, poor cod and Norway pout. Mixed rays is predominantly thornback ray but with the occasional cuckoo ray. The analyst could determine species and sex on most rays caught while they were being gutted, but these have been aggregated so that they can be compared against the skipper's declared ray weights.

Table 3: Trip 2 (6 November 2011) Haul 1

Species	Discarded or retained	Skipper estimate (kg)	REM analyst estimate (kg)
Dab	Discarded	2.6	0
Edible crab	Discarded	0.9	0
Lesser spotted dogfish	Retained	111.6	100
Nephrops	Retained	24.5	25
Plaice	Discarded	45	45.5 (includes dab)
Plaice	Retained	40.8	28
Mixed rays	Discarded	9.1	8
Mixed rays	Retained	4.8	9
Sole	Retained	0.5	0
Whiting	Discarded	23.1	21(includes bib)
Whiting	Retained	0.5	12

The weights for the catch components in Table 3 show that there is very good agreement between the skipper's estimates and the video analyst's estimates for all species except plaice retained, whiting retained and mixed rays retained. The video analyst did not observe the edible crab being discarded, but this may have been included in a different basket during catch processing.

Table 4: Trip 3 (7 November 2011) Haul 1

Species	Discarded or retained	Skipper estimate (kg)	REM analyst estimate (kg)
Dab	Discarded	1.8	0
Gurnard	Discarded	1.2 (red)	1.5 (grey)
Gurnard	Retained	3.6 (red)	4 (grey)
Lesser spotted dogfish	Retained	78.9	70
Plaice	Discarded	73.9	74 (includes dab)
Plaice	Retained	44	22
Mixed rays	Discarded	11.3	7.5
Mixed rays	Retained	38.6	43
Sole	Retained	1.4	1
Whiting	Discarded	4.7	6 (includes bib)
Brill	Retained	0	2.5

As previously stated the red gurnard declared by the skipper appeared to be grey gurnard. Aside from this species confusion the gurnard weight estimate between skipper and analyst were very similar. The estimates for these other species caught on this haul are also very similar between the skipper and the analyst. The exception being the estimates for the retained plaice where the analyst could only see approximately 22 kg compared to the 44 kg declared by the skipper. No brill were recorded by the skipper whereas the analyst saw two large brill processed and estimated the total weight at 2.5 kg.

Table 5: Trip 8 (13 January 2012) Haul 4 and 5

Species	Discarded or retained	Skipper estimate (kg) Haul 4 + Haul 5 = Total	REM analyst estimate (kg)
Dab	Discarded	0.4 + 0.3 = 0.7	0
Brill	Retained	0 + 1.8 = 1.8	0.5
Nephrops	Retained	9.1 + 0 = 9.1	10.5
Lesser spotted dogfish	Retained	18.1 + 0 = 18.1	40
Plaice	Discarded	11.4 + 5.6 = 17	0
Plaice	Retained	4.5 + 9.1 = 13.6	12
Mixed rays	Discarded	37.2 + 17.2 = 54.4	0
Mixed rays	Retained	137 + 137.4 = 274.4	275
Sole	Retained	0	1.5
Cod	Retained	0	3
Others	Discarded	12.2	100

Hauls 4 and 5 on this trip were added together because of the way the catch was processed by the crew. Discards could not be separated into species by the analyst because they were not separated in to species by the crew, but were washed through the scuppers as mixed discards. This was the practice agreed with Cefas for when there were large catches of discards or not enough time to carry out species separation and still make the lock gate tidal window.

The analyst made a bulk estimate of the discards as they were sitting in the pound and as they were washed past the cameras. Where discarding was observed during the processing of individual species, these weight estimates were added to the total bulk discard weight estimate, rather than kept separated in to species.

When all discards declared by the skipper are summated, the total discard weight is 84.3 kg. This is less than the 100 kg estimated by the video analyst. Only one small brill was observed being processed and was estimated at 0.5 kg compared to the 1.8 kg declared by the skipper.

Approximately 40 kg (about two baskets) of lesser spotted dogfish were observed being retained compared to the skippers weight of 18.1 kg and no cod or sole were recorded by the skipper where these were clearly visible to the analyst.

It is interesting to note that the skipper's estimate for rays, 274.4 kg of retained mixed ray, was almost identical to the analyst’s estimate of 275 kg, despite the large quantity caught and the difficulties associated with the two hauls being handled together. The skipper split this almost equally across both hauls whereas the analyst had to process the hauls together because of the way the crew handled the catch – there were a lot of rays caught on haul 4 and these had not been completely processed before more rays from haul 5 were retained and mixed together with those from haul 4. This can be seen in Figure 8. It was observed from the video footage that the rays were not caught in equal weights for each haul and most were retained on the haul 4.

Figure 8: Additional rays being caught on haul 5 with the retained rays from haul 4 still waiting to be processed in the baskets

REM as a verification tool

Although this project was primarily focusing on the feasibility of installing REM technology on board under 10 metres fishing vessels and its reliability, the availability of the Cefas self-reported data allowed the catch estimates between the skipper and the analyst to be compared. This also gave a good insight into whether self reporting by skippers could be an option for a fully documented fishery. Although this is a slightly artificial situation because the crew were conducting a gear trial rather than just routinely reporting catches, it does demonstrate the usefulness of the REM equipment in science projects as well as routine monitoring.

It should be noted that the crew went to great lengths to obtain the correct data for the Cefas gear trials and should be congratulated for their professional approach. The footage clearly showed the crew sorting the catches into species, shovelling into baskets and weighing the catch components.

Discrepancies between the self-reported fishing effort and the sensor data and CCTV verified effort, were identified in the first trip. The sensors provide exact values for fishing time which could be useful in establishing catch rates per hour fished or it could be used to verify declared fishing effort on logbooks or self-reported records.

The self-reported discard weights were often very similar to those observed by the video analyst. Where these weights were different seemed to be on hauls where there were large quantities caught and the crew did not have time to basket up discards before hauling the subsequent haul and instead washed the discards over the side from the pound. As this is likely to be the normal practice, estimating the discard by species would be difficult unless the crew changed their processing practices to make observations easier. The difference is likely to be due to the difficulties faced by the analyst in estimating the quantity in baskets of a moving stream of fish as it washes through the scuppers.

There was also a significant difference between the weights observed and weights recorded for plaice retained on both of the first trips, but because there was no control data from an observer, the real value cannot be ascertained. Given that the video analyst had been quite close in the other estimates it was originally assumed that the skipper had recorded his estimates wrongly or that there was a similar amount of plaice as the one observed that could not be seen by the camera. This was not observed being gutted either which would suggest that the observer estimates were correct. Further discussions with the skipper revealed that the skipper had retained small plaice to be used as pot bait and that this was stored under the sorting table and landed ungutted. A further review of footage established that this was occurring and accounted for the difference in the skipper's estimates and the analyst's estimates of retained plaice. This highlights the importance of understanding the crew's sorting procedures and the importance of discussing these differences with the skipper.

Summary

The installing of the equipment was generally straightforward, but additional structures above deck could be useful in improving video quality or for expanding trials to under 10 metre vessels with more open decks.

The REM equipment was shown to be reliable on board under 10 metre vessels for the majority of the time. There were three trips where a winch rotation sensor on one vessel did not work but all other sensors functioned perfectly on both vessels for the duration of the project. On one occasion a camera unit failed due to poor installation. Seals on camera units should be double checked on installation to ensure no water can enter the system. Power issues resulted in the loss of video data but this loss can be reduced by the use of an UPS or upgrading to the 4.5 system. Lost video is also recoverable using appropriate software. Initially the video loss was thought to be due to the wrong port box being established around the port but this was not the case. However, if there is doubt surrounding the port box or boats fish close to the shoreline, then the REM systems should be set up to record all the time.

Some imagery was out of focus and blurry. This was due to the camera covers becoming dirty. Crews should be instructed to clean all camera covers when safe to do so and on a regular basis and if out of focus, engineers should be called to come and refocus lenses before sailing. On occasions the images appeared grainy at night and this was due to poor lighting. This could be addressed by fitting additional lighting in these areas.

Assessment of fishing effort using the sensors was very accurate and could be used to verify self-reported fishing effort, by trip, haul and towing time.

Quantifying catches was possible and very accurate for the retained part of the catch when gutting occurred or where whole ungutted fish was collected in baskets.

Discard estimates were also possible but were easier to quantify when the crew separated and collected the discard part of the catch in baskets. If this did not occur then only an estimate of bulk discards of combined species could be estimated.

Washing the discards over the side from the pound is likely to be the normal practice, so the crews would need further instruction to allow better discard estimation to occur.

Both vessels continue to carry the REM systems on board and it would be useful for these trials to continue to allow development of handling processes that would give analysts better opportunities to improve estimates of discards by species, but not hamper the crews unduly.

It was useful to compare the REM outputs to the self-reported catch data as the video produced added detail that the catch summaries did not contain, such as missed species such as cod or sole. It showed where the pressures of fishing and large catches impacted on the quality of the self-reported data (such as where a haul was cut short and had to be hauled whilst the previous haul was still being processed or to allow a vessel to reach the lock gates in time).

It was also useful for verifying species identification and could be used to quality assure any self-reported data. The importance of discussing sorting procedures and differences between crew and analyst estimates was also highlighted.

Recommendations

That the trials on board volunteer or part chartered under 10 metre vessels continue to allow handling processes on board this class of vessel to be improved and to allow video analyst estimates of discards when no conveyor or table sorting occurs and discards are washed overboard from the deck pound.

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