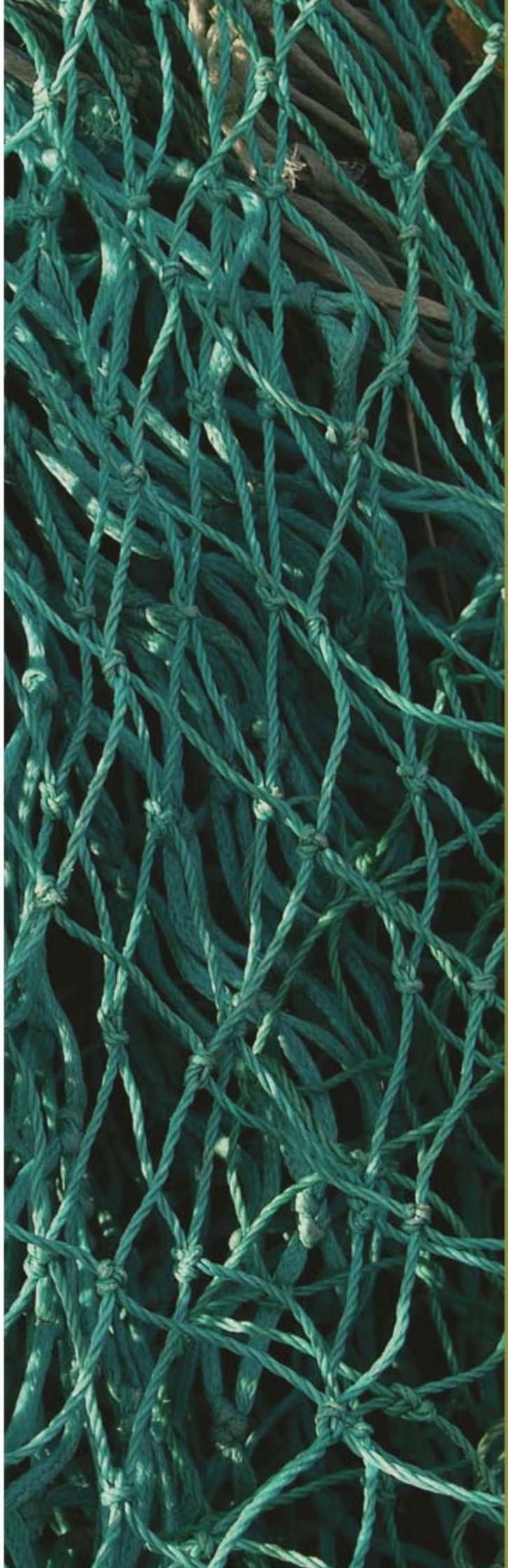




Marine Management Organisation

Catch Quota Trials - South West Beam Trawl

January 2015





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Report prepared by: Julian Roberts, Grant Course, Guy Pasco, Dr Lillian Sandeman

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Marine Management Organisation

Lancaster House

Hampshire Court

Newcastle upon Tyne

NE4 7YH

Tel: 0300 123 1032

Email: info@marinemanagement.org.uk

Website: www.gov.uk/mmo

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Executive Summary

This report provides the results of the Southwest of England fully documented beam trawl fishery scheme in 2013. The trial has demonstrated that the use of Remote Electronic Monitoring (REM) to corroborate self-reported discard data is highly effective, allowing for a high resolution of spatial and temporal trends across a large proportion of the overall beam trawl effort.

The main objectives for 2013 were to:

- Explore the implications of the landing obligation in this mixed demersal beam trawl fishery;
- Investigate plaice (*Pleuronectes platessa*) discard levels by using REM verified self-reported data;
- Continue to trial catch quota management of key demersal species.

Nine participating vessels were fitted with CCTV (REM) and required to operate under a discard ban for at least two catch quota (CQ) stocks. All participants chose Dover sole [*Solea solea*] (ICES VIIe) and anglerfish (ICES area VII), and in addition 4 participants also chose megrim [*Lepidorhombus whiffiagonis*] (ICES area VII) as a third CQ stock. Additional quota for use in fully documented fisheries provided under the provisions of 2013 quota regulations was allocated to participants. Fishing effort was monitored for compliance with the requirement to retain and land all catches of CQ species from a 5% audit of REM data and CCTV footage.

Overall the results show very low levels of discards of CQ species which are comparable to previous trials. Sole (VIIe) below the minimum landing size (MLS) were landed in low quantities (0.2% of total catch); megrim was higher at 4%. A small amount of anglerfish was also not sold on the market because of damage or very small size, giving an unmarketable catch rate of 0.06%.

ICES VIId & VIIe plaice were not chosen as a CQ species because of the difficulties experienced by some vessels in the 2012 trials; both in terms of quota availability and seasonal fluctuations in quality. Participants agreed to fully document plaice discards by sorting into baskets and presenting to CCTV cameras prior to discarding. This allowed for a straight forward process of corroborating self-reported data by reviewing REM data. Results show an average discard rate for VII d&e plaice of 15.5%.

Plaice discards showed a clear spatial pattern in terms of discard intensity. The highest levels of up to 60% per trip occurred around the 12nm limit. This declined sharply to low or zero rates further offshore. The average discard rate was higher in ICES area VIId (23%) than in ICES area VIIe (14%). Confidence in this self-reported data is considered to be high with a close correlation between reported estimates and estimates by observers reviewing REM footage.

The results show that for most vessels on most trips a landing obligation for plaice would have a low impact as very few plaice are discarded. The high levels of discards in the inshore grounds would impact a small number of vessels significantly however, in the absence of improved selectivity or avoidance behaviour. Under a landing obligation smaller vessels targeting sole in high plaice discard areas would need to find additional fish room capacity for up to 3.5 tonnes of low value plaice that might otherwise be discarded.

Overall, the nine vessels in the trial fished in a similar pattern to the rest of the West Channel beam trawl fleet and can therefore be considered to provide a representative sample. The data from those vessels, when raised to fleet level, predicts total discards of approximately 200t against an allocation of 1200t. The data does not include the period January to April during which poor weather may result in increased effort on inshore grounds and when plaice discard rates may be high. The overall figure of 200t may therefore to be an underestimate.

Introduction

Catch quota trials have been undertaken in the Southwest of England since 2011. In the current report year (2013), 9 beam trawl vessels took part in the trial. All trial participants had to accept area VIIe Dover sole and one other species as catch quota species. All vessels chose to accept Area VII anglerfish as their second catch quota stock. Four participants also selected VII megrim as an additional catch quota stock species. In addition, all participants had to agree to report quantities of VIId & VIIe plaice discarded at sea.

For inshore beam trawl fisheries of the western Channel, plaice represent a potential choke species risk when the new landing obligation is introduced for demersal species in 2016. Therefore, plaice discard reporting was introduced as part of the trials.

The experience of participants working in inshore grounds during the 2012 scheme was that it was not practical to retain all plaice catches. Plaice can be a significant by-catch species when vessels are targeting other species, particularly sole. These fish are often discarded if: the plaice are below MLS, there is insufficient quota to land them all, or, the plaice are recovering from spawning and in poor condition.

Objectives

The main objectives of the 2013 SW beam trawl project were to:

- Explore the implications of the landing obligation in this mixed demersal fishery;
- Investigate plaice discard levels by using EM verified self-reported data;
- Continue to trial catch quota management of key demersal species

Quota allocations

In 2012 the additional Vlle sole quota allocated to vessels was 21% and 7 beam trawlers participated in catch quota trials. However the discard rate for Vlle sole in 2012 was reported to be only 5.9% which resulted in a maximum additional allocation of 4.4% for participating vessels in the 2013 catch quota trial. This low incentive was coupled with an additional burden on crews who had to gather plaice discards into baskets for the CCTV. Therefore, no vessel operators were originally interested in joining the scheme.

A stepped approach was therefore taken in the additional quota allocation and an intermediate rate of 15% was agreed upon. The scheme commenced in May 2013 (5 vessels), with two vessels joining in June, one vessel in August and one in October 2013. Details of 2013 catches and additional quota allocation are shown in Annex 1.

Fishing Activity

Participant vessels targeted mixed flatfish, angler and cuttlefish (*Sepia officinalis*) with seasonal and spatial variation in target species and catch composition. Figure 1 shows the haul positions of the participant vessels whilst on the scheme with the hauls observed by shore-based observers coloured red. The majority of fishing effort occurs in VIIe with some activity in VIIId, VIIh and VIIf.

It can be seen from Figure 1 that hauls were sampled (red points) in all ICES areas where fishing activity occurred. Overall over 5% of hauls were selected randomly for analysis of REM CCTV data and footage.

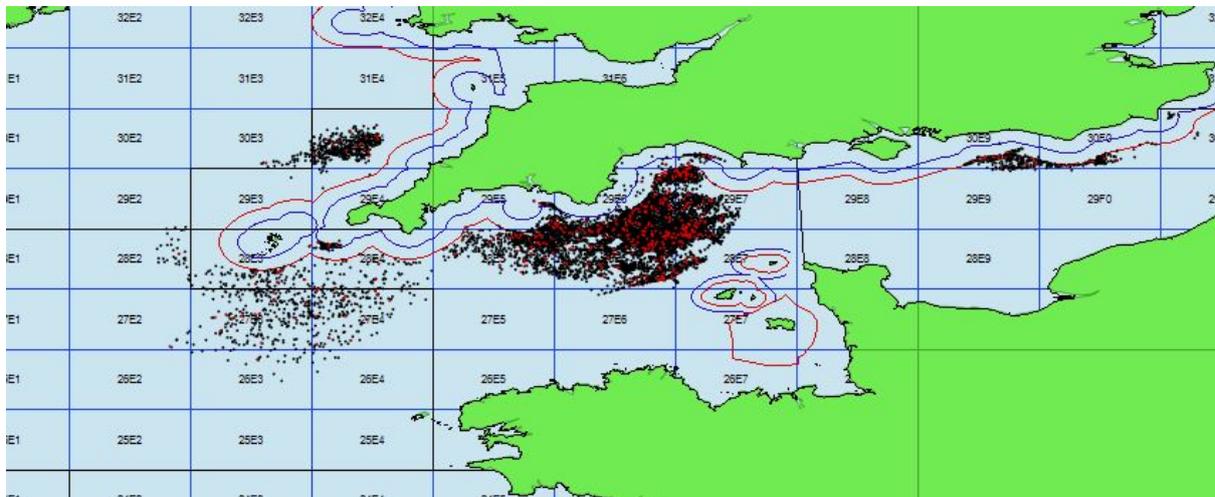


Figure 1: Positions of gear hauls. Positions marked in red are those analysed from REM data.

The participant vessels completed 10777 hauls on 203 fishing trips (see Table 1). REM data from 570 hauls across 195 fishing trips were analysed to give a 5.3% sample rate. Eight trips could not be analysed as a result of missing REM or self-reported data. Therefore 286 hauls (2.7% of those fished) were not sampled.

| Beam trawl | Trips | Hauls |
|--------------------------|-------|-------|
| Total fished | 203 | 10777 |
| Analysed | 195 | 570 |
| Percentage analysed | 96 | 5.3 |
| Unavailable (at 5% rate) | 8 | 286 |
| Percentage unavailable | 4 | 2.7 |

Table 1: Fishing effort sampled ('Unavailable at 5% rate' refers to trips and hauls within those trips for which the data was lost or not of suitable quality)

Adherence to the scheme rules on discards

The scheme stipulates that all catch quota species caught must be retained on board and brought ashore to count against quota. This was to include under MLS and damaged. Sufficient analysis of REM data is therefore required to ensure this condition is being met as well as to quantify the level of any discarding in contravention of the conditions.

Discard estimates for sole and megrim were based on the number of discarded fish multiplied by the weight at length just below the minimum landing size. Angler weights were estimated by eye as either 0.5kg or 1kg depending on size. The conversions are shown in Table 2. This methodology is considered to yield an overestimate of the discard quantities in line with the precautionary approach as most observed discards were of very small specimens.

| Stock | Minimum Landing Size (MLS) in cm | Conversion to kg using MLS minus 1cm | Estimated weight to use for discarded or undersized fish (kg) |
|-------------------|----------------------------------|--------------------------------------|---|
| Anglerfish (VII) | None | Not applicable | Observer estimated. Small at 0.5, Medium at 1 |
| Sole (VIIe) | 24 | 0.12 | 0.1 |
| Megrim (Area VII) | 25 | 0.092 | 0.08 |

Table 2: Calculation of estimated weight used for discarded fish (conversions taken from CEFAS, pers comm.)

Estimated discards of CQ species from observers are shown in Table 3. Estimated sole discards were minimal at 8.85kg, which gave a total raised value of 166kg for the CQ beam fleet. Observers estimated approximately 59kg of megrim and 211kg of anglerfish were discarded on the hauls giving total raised weights of 1140kg and 3986kg respectively. For anglerfish, megrim and sole the discard rates were all below 2% with sole having the lowest of 0.2% discards.

| Species | Total catch (kg) | Raised discard quantity (kg) | Discard rate % |
|------------------|------------------|------------------------------|----------------|
| Anglerfish (VII) | 246486 | 3986 | 1.6 |
| Sole (VIIe) | 99877 | 166 | 0.2 |
| Megrim (VII) | 55661 | 1140 | 2 |

Table 3: Observed discards of CQ species

Undersized and damaged components of the catch were reported on sales notes to allow these to be counted against quota. This component of the catch was not

allowed to be offered for sale and was generally disposed of for crab and lobster pot bait. The total reported quantities are shown in Table 4.

| Species | Declared undersize or damaged quantity | |
|------------------|--|------------------------------------|
| | (kg) | (% of total catch of each species) |
| Anglerfish (VII) | 403 | 0.2 |
| Sole (VIIe) | 315 | 0.3 |
| Megrim(VII) | 3381 | 6 |

Table 4: Quantity and percentage of total catch of declared undersize or damaged catch quota species

Undersized or damaged catches of sole and anglerfish are well below 1%. The low percentage for sole reflects the selectivity of the gear used by participants. For angler, where there is no minimum landing size but relatively poor selectivity for size the unmarketable component is largely damaged fish. Skippers were reluctant to retain all small anglerfish catches as they felt that this species is likely to survive if discarded, thus yielding a higher price if allowed to grow.

The quantity of undersized and damaged megrim is significantly higher at 6% of the total megrim catch. This species is relatively delicate and prone to damage from other catch and debris or through contact with the gear. A small number of catches have contained a high proportion of undersized megrim, suggesting less efficient gear selectivity for this species. Skippers reported that they moved away from areas with a high abundance of small megrim but that the areas were unpredictable.

Given that observed discards of megrim were relatively high at 2%, and that this component is likely to be mainly undersized the total estimate for unmarketable megrim catch comes to just over 8%.

Catches of Megrim by the participant vessels in 2012 were relatively low at just over 26 tonnes. As the allocation of catch quota is based on a percentage of the previous year's landings the vessels were only eligible for a small increase in quota. In 2013, the megrim catch was more than double that of 2012. As such, operators had to source additional megrim quota through swaps to allow the vessels to continue fishing under the landing obligation.

Plaice discards

Plaice discards were self-reported by all vessels. To record estimates of plaice discards, the fish were placed in baskets by the crew in view of a CCTV camera prior to discarding as shown in Figure 2 below. This allowed the crew to make a visual estimate of the total weight of plaice discards based on volume and known weights of full baskets. Plaice discards were self-reported on 6607 out of 9383 hauls for a total of 40.7 tonnes. This is equivalent to a 15.5% discard rate.



Figure 2: Crew member showing basket of plaice to CCTV

During the design of this scheme it was recognised that to quantify all plaice discards on every haul could involve considerable additional work for some crews. Therefore vessels were given a choice as to whether they sampled all hauls (for simplicity) or on every second or third haul to reduce the burden. Skippers had to ensure that they made it clear which hauls had been quantified, to ensure that any zero value estimates were included in the data (see corroboration section below). It was noted that although some vessels had initially intended to estimate plaice on every haul, they could often change procedure between trips. Plaice discard estimates for each haul were therefore raised to trip level using the hauls fished/hauls reported ratio. These raised estimates were then summed to give a total fleet estimate of plaice discarded.

For each trip the plaice discard estimates were raised using the ratio of hauls fished/hauls sampled. Out of the 173 trips fished in VIId & VIle, skippers estimated plaice discards on all hauls on 98 trips (raising factor of 1). The lowest sampling rate on a trip produced a raising factor of 5, and the 1 in 3 haul desired minimum sampling rate was only exceeded on 7 trips. Across all trips the total discard estimate was 40,685kg. A summary of this data is shown in Table 5.

| Total hauls fished VIId & VIe | Total hauls self-reported VIId & VIe | Maximum raising factor on a trip | Minimum raising factor on a trip | Raised weight observed (kg) |
|-------------------------------|--------------------------------------|----------------------------------|----------------------------------|-----------------------------|
| 9383 | 6607 | 5 | 1 | 40,685 |

Table 5: Self-reported plaice discards

Corroboration of self-reported plaice discards

Figure 3 shows the relationship between observer estimates and skipper estimates from the 511 hauls reviewed from REM data. The linear regression shows a high degree of correlation ($R^2 = 0.92$) and provides confidence in the accuracy of the self-reported data. In total for hauls analysed by on-shore observers there were 1703kg estimated by skippers and 1672kg by observers which gives an overall variance of less than 2%.

There are a number of outlying points which represent zero estimates compared to estimates with a value. These contrasting values are restricted to small quantities and are distributed equally between skipper and observer estimates. This may stem in part from a lack of clarity as to whether a zero value recorded by the skipper represented a non-sampled haul or conversely where the observer has failed to observe a discarded quantity from the footage.

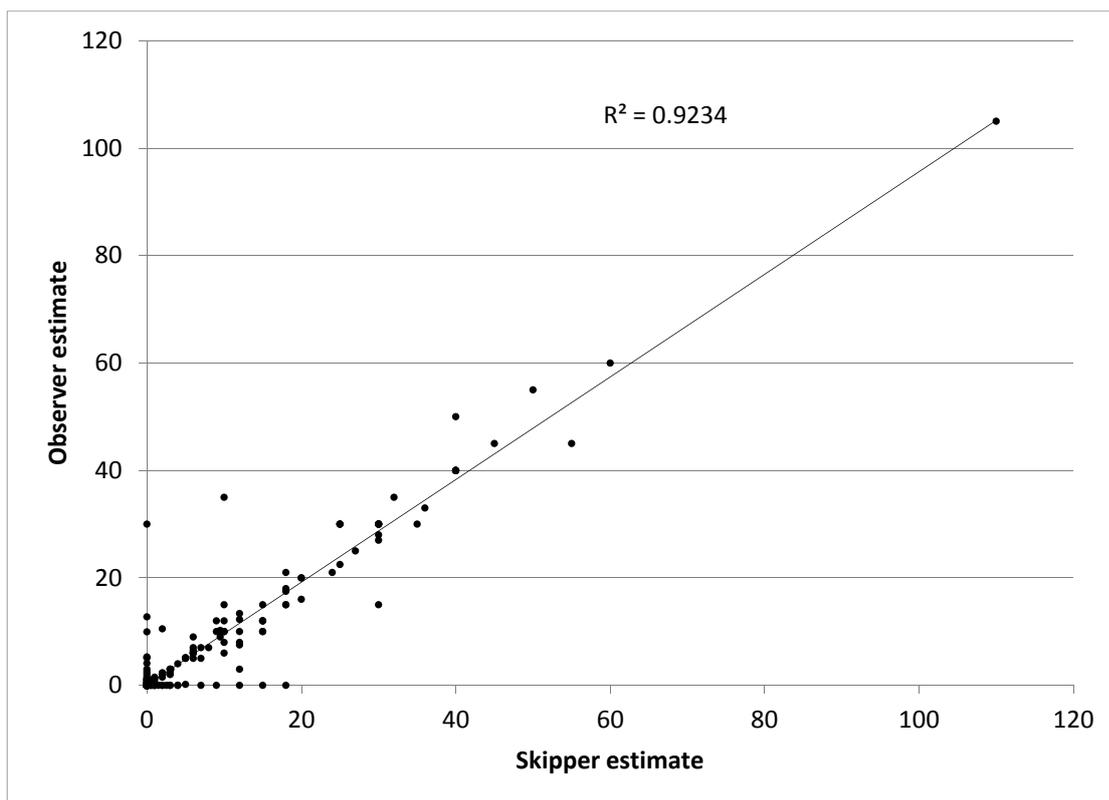


Figure 3: Comparison of plaice discard estimates from skippers and REM shore-based observer analysis

Table 6 shows the self-reported plaice discard data across the whole stock area and broken down between VIIId and VIIe. Although the fishing effort overall was mainly in VIIe where the average discard rate is estimated at 14%, the VIIId discard rate

estimate is considerably higher at 23%. Discard rates varied between 0% and 60% at trip level and between 0% and 100% at haul level.

| Species | Total catch (kg) | Raised discard quantity (kg) | Discard rate % |
|----------------------------------|------------------|------------------------------|----------------|
| Plaice (VIId&e) Self-reported | 263181 | 40685 | 15.5 |
| Plaice (VIId only) Self-reported | 41298 | 9629 | 23 |
| Plaice (VIId only) Self-reported | 221883 | 41056 | 14 |

Table 6: Discard rate and undersize catch rate from analysed trips and self-reported plaice discard records (this table only includes the 195 valid fishing trips which were analysed)

Two trips (in May and September) were accompanied by MMO observers in order to quantify plaice discard rates in more detail. The trips were similar in terms of spatial fishing pattern in that they both involved effort around the 12nm limit off Start Point and further offshore in the Hurd Deep area. Both trips showed a pattern of low discard levels in the offshore area. In the inshore area around the 12nm limit very high discard levels were observed in May and low levels in September. The inshore area is thought to be important as a targeted sole fishery although the catch is still very much multi-species. The high discard levels observed in May are thought to be associated with the poor condition of post-spawning or ‘spent’ plaice at this time of year which yields a very low market price.

Figures 4 and 5 show the spatial plaice discard rate at each haul during trips observed in May and September mapped using GIS software.

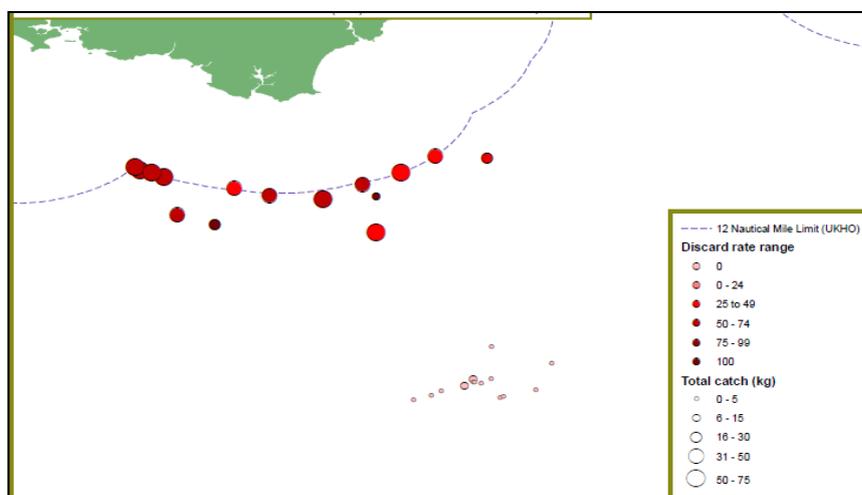


Figure 4: Plaice discard rates observed on an observer sea trip in May.

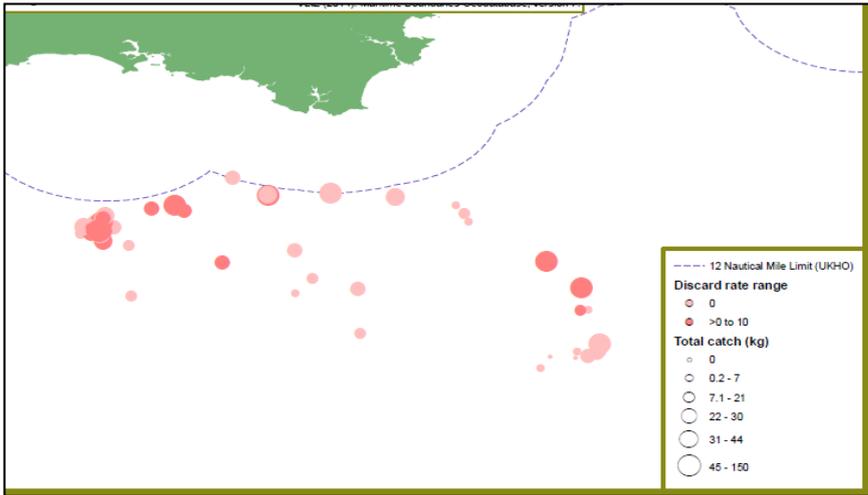


Figure 5: Plaiice discard rates observed on an observer sea trip in September.

The length frequency of plaiice catches retained and discarded in May and September are shown in Figure 6. In the May trip there was a greater proportion of catch below MLS which had to be discarded. There was also a significant proportion of discards above the MLS which reflects discarding because of fish condition. By contrast very few fish below the minimum size were caught and discarded in the September trip and almost all fish above the MLS were retained. These results are not considered to be directly comparable because they involved two different vessels and it is possible that the gear in use during the May trip may have been less selective for size than that used in the September trip; nevertheless these results do appear to demonstrate a seasonal pattern of discards above the MLS.

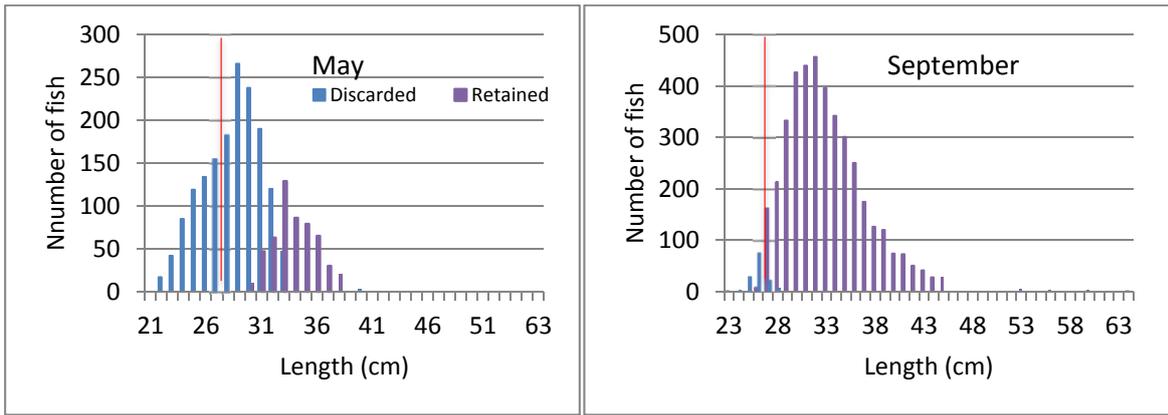


Figure 6: Length-frequency charts of plaiice collected at sea in May and September. The red line depicts Minimum Landing Size

Spatial and temporal variations in plaice discard levels

The position of each haul from which plaice discards were reported is shown in Figure 7 and each point has been colour coded to represent the quantity of discards reported, with yellow being 0kg and dark red being >51kg. The haul positions are taken from the REM sensor data and mapped together with the discard estimates using geographic information system (GIS) software. The highest levels of discards were in ICES VIId near to the 12nm limit line and between Lyme Bay and Plymouth Sound (ICES VIIe) along the 12nm limit line. Figure 7 also shows that for the majority of hauls the discard plaice catches were low or zero.

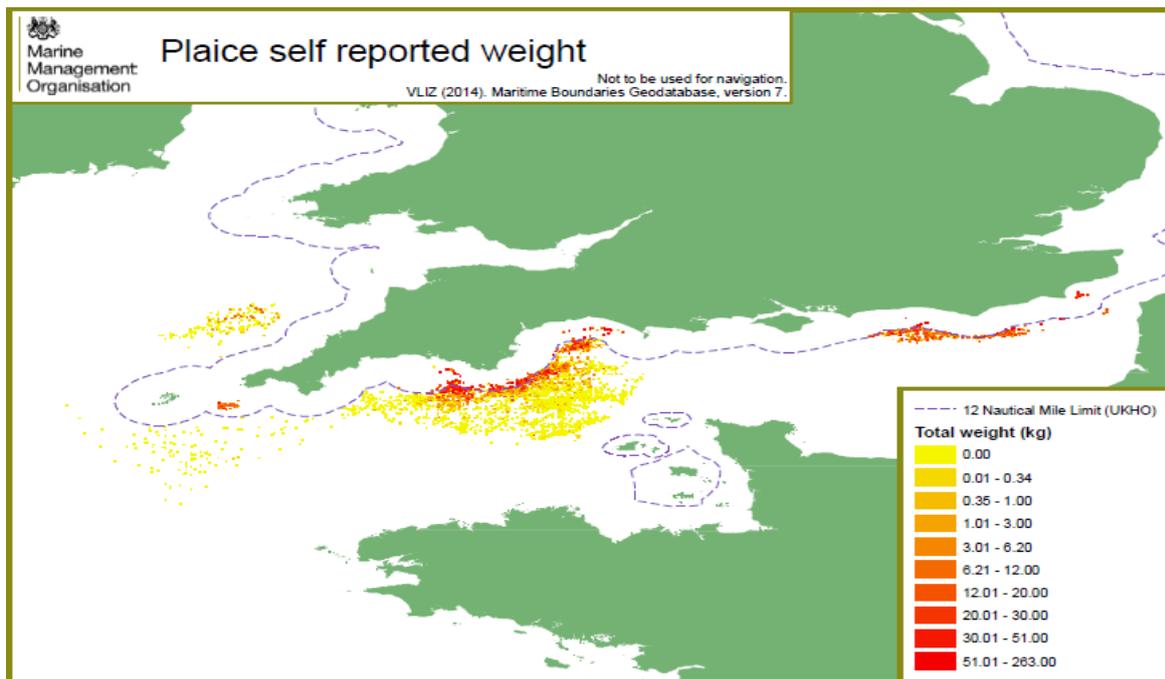


Figure 7: Haul positions showing estimated weight of plaice discards.

The total raised discard estimates are shown in Figure 8 and have been plotted against time to see if there are any seasonal patterns of high discarding. The data was also split to show in which ICES area the trip occurred.

The highest quantity of plaice discards reported on a single trip was 3411kg and a further 9 trips caught >1000kg per trip. On 15 trips discards were between 500-1000kg and on the majority of trips less than 150kg were discarded. Of the total of 195 trips, 10 trips were carried out in VIId where discards of less than 150kg were only estimated on one trip, with 6 of the 10 trips in VIId discarding more than 700kg.

The largest quantities of plaice discards reported, and therefore the greatest variability in discards, mainly occurred in August with additional trips in June and October.

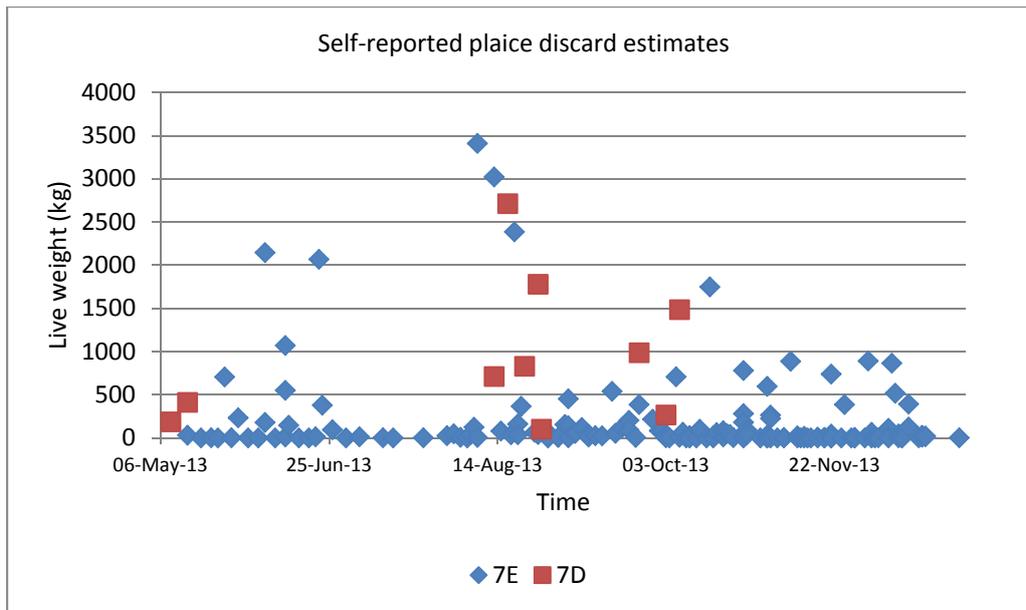


Figure 8: Plaice discard estimates by individual trip. Estimates are colour coded by ICES area.

A typical box of plaice is usually between 40-50kg in weight. So the largest discard levels would equate to approximately 70-85 boxes but with the majority of vessels discarding 3-4 boxes of plaice per trip.

The primary reason cited by the crew for discarding plaice on this trip was poor fish condition. Most of the plaice catch throughout the trip was made up of fish in poor post-spawning condition. Anecdotally, fish in this area can remain in this state for approximately 6 months, from around Christmas through to July-August. Crew on the vessel were of the opinion that quota uplift was not necessarily the answer to this issue, as markets were reluctant to accept such fish for further processing, due to the low fillet yield. Crew also suggested that plaice discards would be higher further inshore (inside 12nm limit) as juvenile fish tended to stay in shallower waters. The waters off Portland were identified as being particularly bad at the time of the trip.

The two sea trips provided useful data on discard rates and length frequency of plaice catches. Very few plaice below 25cm were actually caught. In the later trip (September), this resulted in a very low discard rate as virtually no discarding above the MLS occurred. However this would not have helped on the first voyage in May, where 85% by weight of the discarded plaice were above the MLS and were discarded because they were of poor quality. In total over 62% (705kg) of all plaice were discarded at this time of year.

Discussion and Conclusions

The trial has demonstrated that REM is a powerful tool for corroborating self-reported data. This is evidenced by the high correlation found between plaice discards reported by the skipper and REM shore-based analysis. REM also allows for a high resolution of spatial and temporal trends across a large proportion of the overall beam trawl effort.

Overall, there were very low levels of discards for catch quota species. The levels of discards were comparable with those from previous trials as shown in Table 7 below. Confidence can be had in the 2013 trial results as data integrity was good with 96% of trips being fully documented by both REM coverage and catch records. In addition, the 5% target sampling rate was exceeded with 5.3% of all hauls fished being observed.

| Stock | Discards as % of total catch 2011 | Discards as % of total catch 2012 | Discards as % of total catch 2013 |
|----------------|-----------------------------------|-----------------------------------|-----------------------------------|
| VII Sole | 0.2 | 0.1 | 0.2 |
| VII Anglerfish | 1.0 | 0.7 | 1.6 |
| VII Megrin | - | 0.6 | 2 |

Table 7: Discards as a percentage of total catch for catch quota species

Very few sole were observed being discarded and there were also very low quantities of damaged sole retained which is indicative of the relative robustness of this species coupled with effective selectivity of the gear. The results for sole are consistent with previous trials with the beam trawl fleet.

Larger quantities of very small anglerfish were observed being discarded contrary to the terms and conditions of the scheme. Some skippers, despite agreeing to the terms of the scheme, preferred to discard small anglerfish which they felt were likely to survive to grow to a more marketable size. The combined catch rate of discarded and undersize/damaged anglerfish was less than 2% of total catch. Further investigation would be required to determine whether anglerfish represent a suitable candidate for exemption from the landing obligation on the basis of high survival. It does not appear to represent a choke species to this fishery.

Discards (2%) and reported undersize/damaged megrim (6%) constituted approximately 8% of the total catch for the four vessels monitoring it. The morphology of megrim does not lend itself to selection through gear modification and is prone to damage. In addition, this often unwanted component of the catch may be

difficult to avoid on certain grounds and large quantities of undersized megrim can be caught in a single haul.

In terms of plaice discards, the overall estimate in this trial reflects the very high discard rates in inshore areas at certain times of the year. Plaice are known to be susceptible to mortality and damage from contact with fishing gear, however, estimates of survival rates vary between studies. In general, benthic invertebrates and elasmobranchs have been demonstrated to have higher survival rates than plaice (Depestele et al. 2014, and, Kaiser and Spencer 1995). In addition, survival rates have been demonstrated to be lower both when fish condition is reduced following spawning and in smaller fish (DEFRA internal study, 2012).

On both sea trips, the larger catches of plaice all occurred in the same areas along the 12nm limit and decreased with greater distance offshore. Avoidance of areas known to have high catches of plaice, in particular at times of year when fish condition is poor, would therefore be a preferential option. In particular as there appear to be clear spatial patterns in catches. However, an incentive would be required for vessels to avoid certain areas and times as travelling to offshore grounds may increase fuel costs and potentially reduce catches of other commercial species.

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Kaiser and Spencer (1995) Survival of by-catch from a beam trawl, Marine Ecology Progress Series, Volume 126: 31-38.

Annex I – Catch and allocation by species and vessel

| Species | Vessel | 2013 Total catch (tonnes) | Additional allocation (tonnes) | Additional allocation as a percentage of 2013 total catch |
|------------|--------------|---------------------------|--------------------------------|---|
| Sole | 1 | 18.98 | 2.0 | 10.5% |
| | 2 | 7.03 | 1.3 | 18.5% |
| | 3 | 15.09 | 2.2 | 14.6% |
| | 4 | 14.88 | 2.3 | 15.5% |
| | 5 | 18.21 | 3.5 | 19.2% |
| | 6 | 16.08 | 2.6 | 16.2% |
| | 7 | 17.71 | 2.9 | 16.4% |
| | 8 | 16.44 | 3.2 | 19.5% |
| | 9 | 26.78 | 3.6 | 13.4% |
| | Total | 151.20 | 23.3 | 15.4% |
| Anglerfish | 1 | 45.98 | 3.1 | 6.7% |
| | 2 | 79.75 | 5.5 | 6.9% |
| | 3 | 14.75 | 1.7 | 11.5% |
| | 4 | 14.87 | 1.6 | 10.8% |
| | 5 | 47.21 | 5.9 | 12.5% |
| | 6 | 63.83 | 5.7 | 8.9% |
| | 7 | 52.60 | 5.3 | 10.1% |
| | 8 | 52.77 | 3.7 | 7.0% |
| | 9 | 62.58 | 7.8 | 12.5% |
| | Total | 434.34 | 41.8 | 9.6% |
| Megrim | 6 | 5.64 | 0.2 | 3.5% |
| | 2 | 61.07 | 1.9 | 3.1% |
| | 3 | 0.40 | 0.0 | - |
| | 4 | 4.78 | 0.2 | 4.2% |
| | Total | 71.90 | 2.3 | 3.2% |