



© Cefas, Tom Catchpole

Final Report: The English Discard Ban Trial

Tom Catchpole, Sam Elliott, Dave Peach, Stephen Mangi

October 2014



Department
for Environment
Food & Rural Affairs



© Cefas, Tom Catchpole

Project Title: The English Discard Ban Trial

Defra Contract Managers: Nuala Carson and Ashley Wilson

Funded by: Department for Environment, Food and Rural Affairs (Defra) and the European Fisheries Fund (EFF)

Department for Environment, Food and Rural Affairs (Defra)

Marine Science and Evidence Unit

Marine Directorate

Nobel House

17 Smith Square

London SW1P 3JR

Authorship:

Tom Catchpole (Cefas), Sam Elliott (Cefas), Dave Peach (Cefas), Stephen Mangi (Cefas)

Disclaimer: The content of this report does not necessarily reflect the views of Defra, nor is Defra liable for the accuracy of information provided, or responsible for any use of the reports content.

To reference this report:

Catchpole, T., S. Elliott, D. Peach, S. Mangi (2014). Final Report: The English Discard Ban Trial, Cefas report, pp65.

Executive Summary

A new EU Common Fisheries Policy (CFP) came into force on 1st January 2014. Article 15 of the new CFP basic regulation introduces a discard ban or landing obligation in EU fisheries where the discarding of quota species is prohibited. There is an urgent need to understand the impacts of this new policy on the UK fishing industry, and fishing industries elsewhere in Europe, of a ban on discards. In order to maximize the revenue from new catch quotas, fishermen will be motivated to avoid catching fish that will result in a curtailment of the fishing season (sometimes referred to as 'choke species') and avoid catching undersized, and low-value fish, which would be deducted from their quota. However, given the mixed-species nature of many fisheries, some unwanted fish will continue to be caught which will have to be landed. We have conducted a discard ban trial to provide an opportunity for the fishing industry to demonstrate what a landing obligation would mean for them. The results are mostly illustrative and qualitative, and designed to inform policy decisions but also identify areas of future work to assist in the implementation of the new CFP.

The discard ban simulation trial was successfully conducted to inform fisheries managers, policy makers and the fishing industry on the various practical issues and challenges of implementing a discard ban in England. This is the first and only study of its kind in Europe to date. The trial focussed on how fishing practices, catch handling, storage and transport could change as a result of the obligation to land all catches. The trial involved eight vessels of different sizes, gear types and from different ports along the south coast of England for up to five months. All fish caught were documented and there was a high level of confidence in the compliance and in the quantities and reported destination of those catches at first sale. Overall, 128 fishing trips were conducted during the trial of which 40 had a scientific observer onboard. During the trial, the total recorded weight of otherwise discarded catches caught by all vessels was 27,171 kgs (an average 212 kg per trip). This equated to an average of 141 kg of quota species per trip, although not all of this would be expected to come ashore under a landing obligation, as some would be avoided by the skippers and some of these discards were driven by quota restrictions. Figures generated by the skippers were validated by independent scientific observation and by a fishmeal plant, which received most of the otherwise discarded material. Conclusions are made on the drivers for discarding under the current management regime, on the practical considerations for landing all catches, the economic impacts of a discard ban, the potential impact on fishing mortality and the implications for enforcing the discard ban.

Ten recommendations are made, which are considered would assist in the implementation of the landing obligation. These include, providing advice to ensure that the safety of fishers is not compromised by the landing obligation; working with Producers Organisations and national fisheries managers to ensure the highest levels of flexibility in quota usage both internationally and domestically; analysing in real-time the catch data from vessel operators, registered buyers and sellers and independent scientific observations during the implementation phase of the landing obligation; preparing to deal with discrepancies between real-time data and forecast catch rates; having a designated role to ensure that any material destined for non-human consumption can be handled at ports and transported; prepare for the likelihood of more small, but legally sized fish on the human consumption market; testing of the e-log system in recording all components of the catch; assessing how data sources can be integrated to deliver full documentation of catches in the non-sector under-ten metre fleet; and evaluate the extent to which the current observer programme can serve to provide a reference fleet to validate self-reported catch data.

Contents

1. INTRODUCTION	5
1.1 Aims and objectives	6
2. APPROACH AND METHODS.....	7
2.1 Project structure	7
2.2 Terms and conditions of participation by vessel operators.....	12
2.3 Arranging outlets for the unwanted catches.....	15
2.4 Participant experiences of the trial	16
3. RESULTS	17
3.1 Validating self-reported data	17
3.2 Discard data analysis	19
3.2.1 Total unwanted catch caught and landed during the trial.....	19
3.2.2 Catches of quota species released at sea.....	21
3.2.3 Landings of otherwise discarded catches	21
3.3 Observations onboard handling, sorting and storage of catch.....	28
3.4 Economics of landing material for fishmeal	32
3.5 Markets for otherwise discarded catches	35
3.6 Perceptions of skippers and market managers	36
3.6.2 Changes to normal fishing practices.....	36
3.6.1 Practical constraints once unwanted catches were landed.....	39
3.6.3 Identifying potential ‘choke’ species.....	45
3.6.4 Potential for selectivity improvements and survival of discards.....	49
3.6.5 Views on control and enforcement.....	50
4. CONCLUSIONS	52
4.1 Assessment of the fish caught – reasons for discarding.....	52
4.2 Practical considerations of a discard ban (e.g. sorting, storage, transport, ports, unsold fish)	53
4.3 Economic impacts of a discard ban.....	56
4.4 Markets for currently discarded fish	58
4.5 Impact on fishing mortality of a discard ban compared with current practice	58
4.6 Enforcement of a discard ban	59
5. RECOMMENDATIONS.....	62
6. ACKNOWLEDGEMENTS.....	63
Appendix 1 Dispensations required to progress the project	64
Appendix 2 Vessel tendering process	65
Appendix 3 Questions for participating skippers/markets	66

1. INTRODUCTION

A new EU Common Fisheries Policy came into force on 1st January 2014. Article 15 of the new EU Common Fisheries Policy (CFP) basic regulation introduces a discard ban or landing obligation in EU fisheries where the discarding of quota species is prohibited. All catches of pelagic and demersal species with associated quotas have to be landed, except where the fish are prohibited, will be used for live bait, or have demonstrably high survival rates when discarded and an exemption is regionally agreed. In some circumstances, a *de minimis* level, of up to 5% (after a transitional period of 4 years, up to 7% in years 1 and 2 of the discard ban and 6% in years 3 and 4 of the discard ban) of the total catch may be discarded if there are disproportionate costs to handling and storing the fish on board or improving selectivity is proven to be difficult (European Commission 2013). This represents a fundamental shift in European fisheries policy as it switches the focus from the regulation of landings to the regulation of total catches. The new CFP will lead to changes in fishing operations, fish handling and marketing as previously discarded catches are brought to shore. There is therefore a need to evaluate how the landing obligation will impact on fishing vessels, fishing practices and the economic viability of fishing fleets in England.

The discard ban will be phased-in from 1st January 2015 and will initially begin with pelagic stocks. The discard ban will be extended to cover all other stocks between 2016 and 2019. It will apply to all other EU waters for all quota species and those subject to minimum legal landing sizes in the Mediterranean by the end of 2019. The principles of the new CFP toward discards are:

- All catches will be subtracted from a quota (hereafter catch quota)
- Once a catch quota is met fishing operations will stop
- All catches of fish (with catch quota) will be retained on board, recorded and landed (i.e. a discard ban)
- Implementation will occur within a phased approach with a defined timetable (2015-19)
- Some exemptions can apply where these can be substantiated
- Fish subject to catch limits which are under a minimum conservation reference size (MCRS) must be sold into the non-human consumption market.

Historically, regulations and market forces motivated fishermen to discard their catches, and if a vessel operator exhausted the quota for a species, they were legally required to discard any further catches of those. In the reformed CFP, the European Commission is seeking to reduce unwanted catches and eliminate discards. Catch quotas will place a direct cap on fishing mortality, requiring all catches (not just landings) to be deducted from the quota and once the catch quota of a species is reached, fishing activities must stop.

By introducing the land-all catch policy (discard ban) therefore, the costs of catching unwanted fish will be internalised, which should motivate vessel operators to avoid catching low value fish and the most restricted species. For instance, in order to maximize the revenue from the catch quotas, fishermen will need to avoid catching fish that will result in a curtailment of the fishing season (sometimes referred to as 'choke species') and avoid catching undersized, and low-value fish, which would be deducted from their quota for little or no profit. Therefore, the principle of the discard ban is to make fishing more environmentally and economically sustainable as fishermen change their methods to maximise the revenue from their quotas.

However, given the mixed-species nature of many fisheries, some unwanted fish will continue to be caught under a discard ban which will have to be landed. Further, the application of legal minimum conservation reference sizes (MCRS) which are designed to prevent the intentional targeting of juvenile fish, (EC 2013), will prevent the smallest fish entering the human consumption market. If these are caught and landed therefore, they will have to be utilized in some other way. This means that appropriate utilisation opportunities need to be developed to prevent discards at sea being turned into discards on land.

If fishermen are required to land everything they catch this will impact on the sorting practices on board fishing vessels as the crew will be required to separate what catch will be landed to the human consumption market from the catch that will be put to other uses. Further, other operating costs, such as boxes, ice and landing fees will most likely increase if fishermen are required to land previously discarded catches. Landing ports may also need to develop onshore handling, storage and refrigeration facilities for the catch that is not destined for human consumption as these may not be able to mix with the landings for the human food chain.

With the reformed CFP in force from 2014 and the landing obligation to be implemented in pelagic targeted fisheries in 2015, there is an urgent need to understand the impacts of this new policy on the UK fishing industry, and fishing industries elsewhere in Europe, of a ban on discards. We have conducted a discard ban trial to provide an opportunity for the fishing industry to demonstrate what a landing obligation would mean for them. The results are mostly illustrative and qualitative, and designed to inform policy decisions but also identify areas of future work to assist in the implementation of the new CFP.

1.1 Aims and objectives

This study explored the potential impacts of a discard ban including the cost and logistics of landing the whole catch and the use that can be made of the catch that is not destined for human consumption. This was accomplished through a discard ban trial on four under 10m and four over 10m vessels using beam trawls, otter trawls and nets (gill, tangle and trammel). The aim was to inform fisheries stakeholders on how fishing and processing operations would need to change as a result of the reformed CFP. This trial builds upon evidence and lessons learnt from a Cefas discard ban scoping trial which took place in 2011 and aims to provide a practical experiment to understand the implications of a discard ban on the catching sector and to inform discussions on how a landings obligation can incentivise selective fishing. This is the first and only study of its kind that has been conducted in Europe.

Specifically, the aim of this trial was to inform English fisheries managers on various aspects of implementing a discard ban including the:

- Assessment of the fish caught – reasons for discarding
- Practical constraints (e.g. sorting, storage, transport, ports, unsold fish)
- Economic impacts of a discard ban
- Markets for fish otherwise discarded
- Impact on fishing mortality compared to current practice
- Enforcement of a discard ban

It is worth noting that this project was initiated in 2012 before the final details of the new CFP were agreed in 2013. Therefore, although the inclusion of a discard ban was expected, there was uncertainty around the exact details of the policy. In the trial we simulated a discard ban on all commercial species, these were defined as species, for which some part of the catch is normally landed and sold by each vessel but also included species for which there is no associated quota. This differs from the final agreed landing obligation, whereby only regulated species will be affected. The landing obligation will apply only to those species with catch limits (quotas) therefore more species were included in this trial than will be required under the reformed CFP. However, the results and findings are presented to account for this discrepancy to reflect the landing obligation as finally agreed.

2. APPROACH AND METHODS

2.1 Project structure

The trial was completed with input from a project steering group comprised of key stakeholders from the project inception to finish. Two start-up meetings were held before the trial began. The first, attended by representatives of Cefas, Defra, Marine Management Organisation (MMO) and the fishing industry was to outline the scope of the trial and discuss key issues related to the practicalities, difficulties and obstacles of the project. The second meeting was with representatives of Cefas, Defra, MMO and United Fish Industries (UFI), and was held to agree on the most useful trial design and structure. The main conclusions of these discussions were the trial needed to identify the main practical issues associated with a discard ban. It was hoped that it would also demonstrate the drivers of discarding in selected fisheries and assist the development of fishery specific mitigation measures. Fishing industry representatives requested that the trial identify choke species which could have substantial economic impacts for the industry. It was recognised that, due to the resources available, the trial would provide information on selected fisheries and from a small number of vessels from those fisheries.

Skippers of participating vessels were expected to land all of the commercial species they would normally discard due to either an absence of quota, the fish being below the legal minimum landing size (MLS) or because the skippers thought it was not marketable. Any prohibited species or zero TAC species e.g. spurdogs and undulate rays, could not be landed and were recorded before being released. Some fish, which skippers were confident would survive if thrown back, were also released and recorded. Skippers were asked to sort the catches and separate them into two landed categories: that destined for the human consumption market and the unwanted catch destined for the non-human consumption market. For each trip, skippers were required to record the weights of the unwanted catches by species and whether they were retained onboard or released. The reasons for otherwise discarding these catches and the final destination of this material were also recorded on log sheets provided. Cefas observers accompanied participating vessels on selected trips to independently record the catch and collect length data.

Vessels on the trial were not provided with additional quota, and only the fish that were sold on the human consumption market were deducted from the vessels quota. An artefact of the project design was that when fish over the MLS were landed but not sold on the human consumption market, it was not deducted from the vessels quota. Moreover, when a vessel exhausted the quota for a species, all catches of those species

were landed but could not be sold on the human consumption market. This was a condition of the trial agreed with the control authority, the MMO. Similarly, fish under the MLS could not be landed for the human consumption market, and nor could these fish be legally used as bait in pot fisheries.

Under the agreed new policy, when a skipper exhausts his quota and cannot obtain additional quota through the available channels, the vessel will be required to stop fishing. Furthermore, undersized fish will not be able to go onto the human consumption market but could be used as pot bait or sold into the non-human consumption food chain such as fish meal. There are, therefore, differences between the simulated ban in this trial and the agreed landing obligation. However, the key aims of informing on logistical issues off- and on-shore of handling previously discarded catches, the associated economic implications under the landing obligation, the drivers of discarding and the estimated catches for participating vessels can all be achieved with the trial as designed.



MFV Govenek of Ladram

© Cefas, Tom Catchpole



MFV Admiral Grenville

© Cefas, Tom Catchpole

Table 1: Characteristics of selected vessels

Vessel name	Vessel size	Home port	Port of landing during trial	Main gear	ICES area	Months fished during the Trial	Number of trips during trial	Number of observed trips during trial
Virgo	>10m	Brixham	Brixham	Otter Trawler	VIIe	Dec, Jan, Feb, March, Apr	38	3
Guiding Light III	>10m	Plymouth	Brixham	Otter Trawler	VIIe	Dec, Jan, Feb, March	41	3
Govenek of Ladram	>10m	Penzance	Newlyn, Brixham, Plymouth, Exmouth, Roscoff	Netter	VIIe,f,g,h,j,k	Nov, Dec, Jan, Feb, Mar	9	2
Admiral Grenville	>10m	Plymouth	Plymouth	Beamer	VIIe,h	Nov, Dec, Jan, Feb	10	2
Alfie Elliot	<10m	Hastings	Hastings	Netter	VIIId	Feb, Mar	6	6
Girl Kayla	<10m	Hastings	Hastings	Netter	VIIId	Feb, Mar	8	8
Kaya	<10m	Hastings	Hastings	Netter	VIIId	Feb, Mar	8	8
Oliver Henry	<10m	Hastings	Hastings	Netter	VIIId	Feb, Mar	8	8

MFV Guiding Light III



© Cefas, Tom Catchpole



MFV Virgo

© Cefas, Tom Catchpole

2.2 Terms and conditions of participation by vessel operators

It was imperative that catches were accurately recorded during the trial. Therefore, participating vessels were contracted to fully document and submit information about their catches on a project log sheet (Table 2), and provide notification of landing. Vessels over 10 m in length participating in the trial were required to continue to give prior notification of landing and record unwanted catches by completing the project log sheets and landings through their e-logs in the usual way.

Table 2: The project log sheet that was provided to each skipper to collect data during the trial

Cefas log sheet for Discard Ban Simulation

Notes:

- 1) All landings to be entered on EU log book
- 2) Land all catches of all species that are usually landed by the vessel
- 3) Prohibited species should be recorded and released (code = REL)
- 4) Only non-human consumption landings (material not going to market) to be recorded on this sheet
- 5) All species with quota and/or legal minimum landing size must be processed for fish meal
- 6) One log sheet should be completed for each landing event
- 7) Weights for each species should be given where possible, group species codes when this is not practical

Date landed	Species	Category	Weight (kg)	Destination	Storage	Iced	Weighing
17/1/13	DAB	NMA	10	IND	BOX	Y	EST
	WTH	NMA	15	IND	BOX	Y	EST
	PLB	NMA	75	IND	BOX	Y	EST
	SMD	NMA	20	IND	BOX	Y	EST
	MIX	NMA	10	IND	BOX	Y	EST
	REL	REL	70	REL		Y	EST

Vessel: VINGO

Skipper notes:

Code	Description	Code	Description
Category		Storage on vessel	
UMLS	Under minimum landing size	BOX	boxes
QUR	Quota restricted (incl. high graded)	BGS	bags
NMA	No Market	BUL	bulk fish
Destination		CNT	containers
IND	Industrial use (fish meal)	Iced	
BAI	Bait	Y	Yes
WST	Waste	N	No
UNK	Unknown	Weighing	
OTH	Other - please specify	EST	Estimated
REL	Released back to sea	WGH	Weighed

The first draft of the terms and conditions stated that vessels under 10m also had to have the catch sorted, with the otherwise discarded component separated, and for log sheets to be completed and posted in a box at the port before any fish came ashore. However, the skippers of these vessels considered this to be impractical due to the difficulties in storing different parts of the catch separately onboard with restricted space and in accurately estimating weights for small components of the catch at sea.

An alternative option was proposed, whereby vessels owners could either:

- a) document estimated weights for their catch and post the log sheets before fish was brought ashore, in which case they would receive a fixed monthly payment for their continuous participation in the discard ban trials.

Or

- b) be accompanied by a Cefas observer on every fishing trip during the trial (up to a maximum of 10 trips), who will take an independent record of the full catch and receive one-off payment for each trip completed.

All of the skippers of the <10m vessels opted for option b.

MFV Kaya



© Cefas, Tom Catchpole

MFV Alfie Elliot



© Cefas

2.3 Arranging outlets for the unwanted catches

Once the vessels had been selected, meetings were held with the relevant port authorities (Brixham, Plymouth, Newlyn and Hastings) where the selected vessels landed most of their catch. This was to ensure that the people managing and working on the markets were aware of the trial and discuss areas for storage of the unwanted catches and handling requirements on the quay. It was vital that the unwanted catch had somewhere to go once it was landed and therefore before the trial began, arrangements were made for utilising this material.

Options for utilisation were discussed at initial meetings. These included sending the material for: a) energy production; b) fishmeal; c) composting; and d) silage. It was decided that the most suitable option would be to send the otherwise discarded material to the United Fish Industries (UFI) to be converted into fishmeal. This was chosen as it would provide a guaranteed beneficial outlet for the discarded material. In reality, industry will be able to access a range of non-human consumption markets to maximise profits from the previously discarded catch. The UFI plant in Grimsby was the closest fishmeal factory to the ports where participating vessels would be landing (the average distance from the plant to ports was 327 miles). Further, UFI had already played a similar role during the discard ban scoping study. UFI provided storage bins into which the unwanted catches could be deposited, stored and transported.

The vessel owners were paid for all the material that was sent to UFI. Before payment could be made, participating vessel owners were required to acknowledge UFI's raw material specification / declaration and specify what material was being sent, where it came from and acknowledge that the material is suitable for use as fishmeal. This evidence is required by FEMAS (Feed Materials Assurance Scheme) to demonstrate that the material is safe to use as animal feed.

Transport of the material from the ports to Grimsby was also arranged prior to the start of the trial. One company, Quayside, regularly travels to and from Brixham, Newlyn and Plymouth and their Lorries were able to transport the material from these ports. Hastings, being a much smaller port, was not on their route and transport was therefore arranged with another company, Cornwall Transport. All of the transport was paid for by the project, this was so all of the costs could be captured for the economic analyses. The project therefore subsidised these transport costs and vessel owners received the full payment for the material they sent.

2.4 Participant experiences of the trial

To provide a reference for normal fishing practices, informal discussions were held with all skippers, market managers and managers from UFI. A questionnaire with open-ended questions was used (Appendix 3) to gather the thoughts of participants towards the trial, species discarded and reason for discarding, whether they had changed their fishing practices during the trial and their thoughts towards the new CFP.



© Cefas, Tom Catchpole

3. RESULTS

3.1 Validating self-reported data

During the trial, Cefas observers accompanied participating vessels to independently record the catch and collect length data. Observers used standard Cefas discard sampling protocols collecting haul by haul data. The observer trips provided quality assurance and control on the self-reported data generated by the skippers. Overall, 128 fishing trips were conducted during the trial of which 40 had an observer onboard, equating to observer coverage of 31% for the trial. To enable the study, 100% observer coverage of the under 10 metre vessel was required; there was a 10% coverage of trips undertaken by the over 10 metre vessels.

Vessel operators of the over 10m vessels were asked to separate the catch at sea into fish to be sold on the human consumption market from the fish which would normally have been discarded. This component of the catch was sorted into species and skippers recorded the following information on the project log sheets:

- Species (three letter code)
- Weight (live kg) indicating whether as an estimate or actual (measured)
- One of the following four reasons as to why the fish would have been discarded
 - I. Below minimum landing size (MLS)
 - II. Over quota (including high grading)
 - III. Not marketable
 - IV. Damaged
- Storage (boxed, storage bin)
- Whether this material was iced
- Destination (including whether the fish was released at sea or sent for fishmeal).

This information was recorded at a trip level. Cefas observers, rather than skippers, generated this data for the under 10 m vessels. The weight of unwanted catches from the project log sheets were compared with that from the observed trips. There was a close correlation between the log sheet data and the observer data (R-squared = 0.84) (Fig 1 (a))¹. The slope of the modelled relationship between the skipper's and observer data indicates consistent differences between the two estimates. Here we saw a slope of less than 1, which shows that the skipper's estimates of the weight of unwanted catches were generally less than that of the observer.

For the over 10 metre vessels neither the skipper nor the observer weighed the catches; observer weights were estimated by converting measured length data using length-weight relationships, while the skipper simply estimated the weight from experience. For the under 10 metre vessels, for which the observer weighed all of the unwanted catches the observer calculated weights closely matched the actual weight measurements (slope 0.95)(Figure 1 c). Overall, the results indicate that the skippers' data consistently predicted the observers' estimates sufficiently well to enable the use of the skippers' data in a broader analysis of the estimates of the otherwise discarded catches.

¹ R-squared is a statistical term that describes how good one term is at predicting another. If R-squared is 1.0 then given the value of one term, you can perfectly predict the value of another. A high value of R-squared means that you can better predict one term from another.

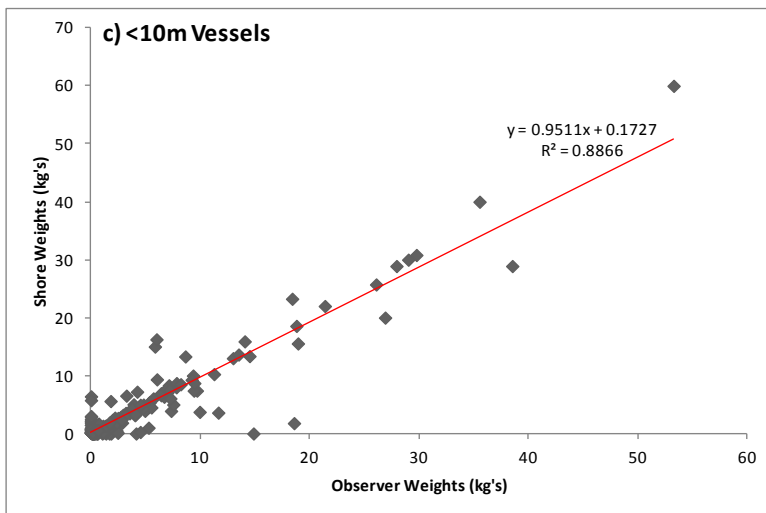
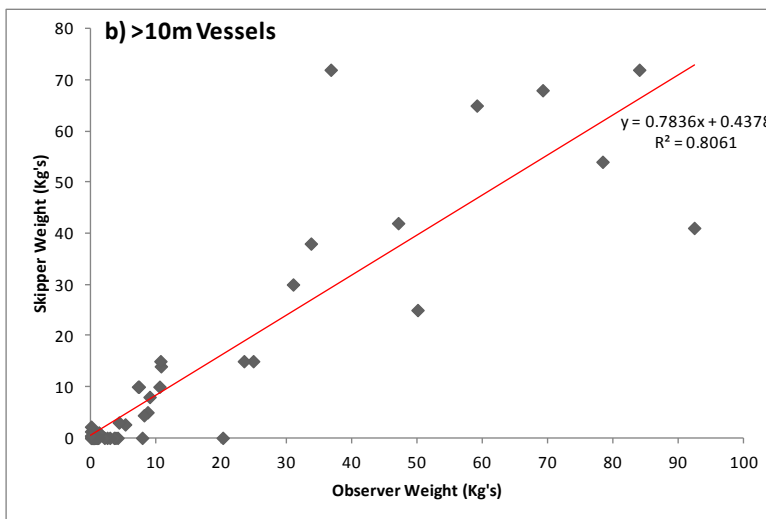
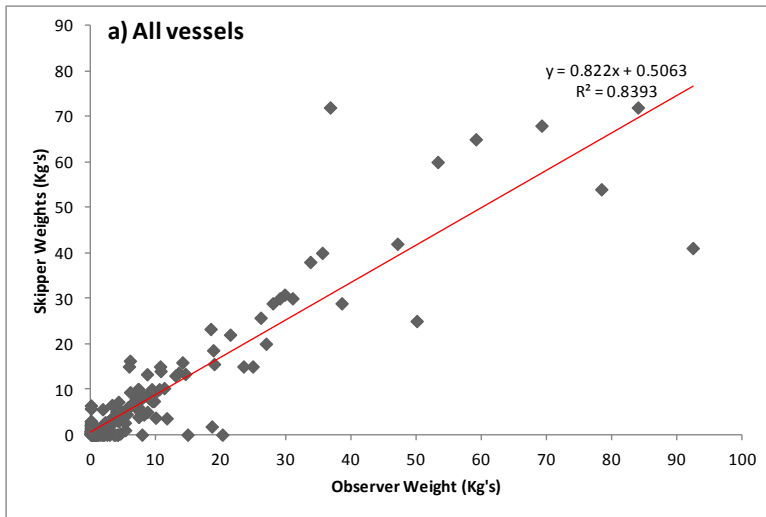


Figure 1: Comparison of quantities of otherwise discarded catches as estimated by the observer and skipper

3.2 Discard data analysis

3.2.1 Total unwanted catch caught and landed during the trial

During the trial, the total recorded weight of unwanted catches caught by all vessels was estimated by the skippers to be 27,171kgs (an average 212 kg per trip). This equated to an average of 141 kg of quota species per trip. Of the total quantity 70% came ashore and was sent to the fish meal factory and 30% was released at sea (Figure 2). Fish were released because either the species could not be landed under the conditions of the trial or because the skippers were confident the fish would survive.

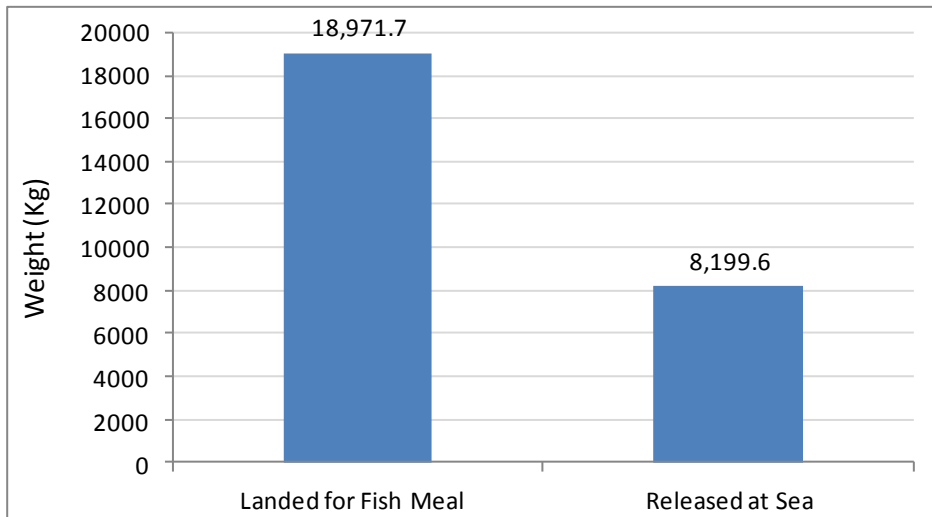


Figure 2 Total weight of unwanted catches caught during the discard ban trial.

The cumulative weights of landed unwanted catches recorded by the skippers (and observers for the under 10 metre vessels) and recorded by UFI upon arrival at the fish meal factory were sufficiently close (Figure 3) to give confidence that almost all of this material was accounted for. There is a lag time between the time at which the skipper recorded the weights and UFI recorded the weight depending on the time between landing and the material arriving at Grimsby. The total weight of discards received by UFI were 22 tonnes, all material was weighed on arrival. This represents a 14% difference between the final weight received by UFI and the weight recorded by the skippers, however, skipper's weights were generally estimated. The 14% discrepancy provides an indication as to the accuracy with which the material can be recorded. The close correlation between the skippers and UFI data further strengthens the validation of the skippers' data; a recording mechanism at the point of delivery of the non-human consumption provided a useful validation of the skippers reported landings. However, the data from the fishmeal plant did not provide a breakdown by species or size composition.

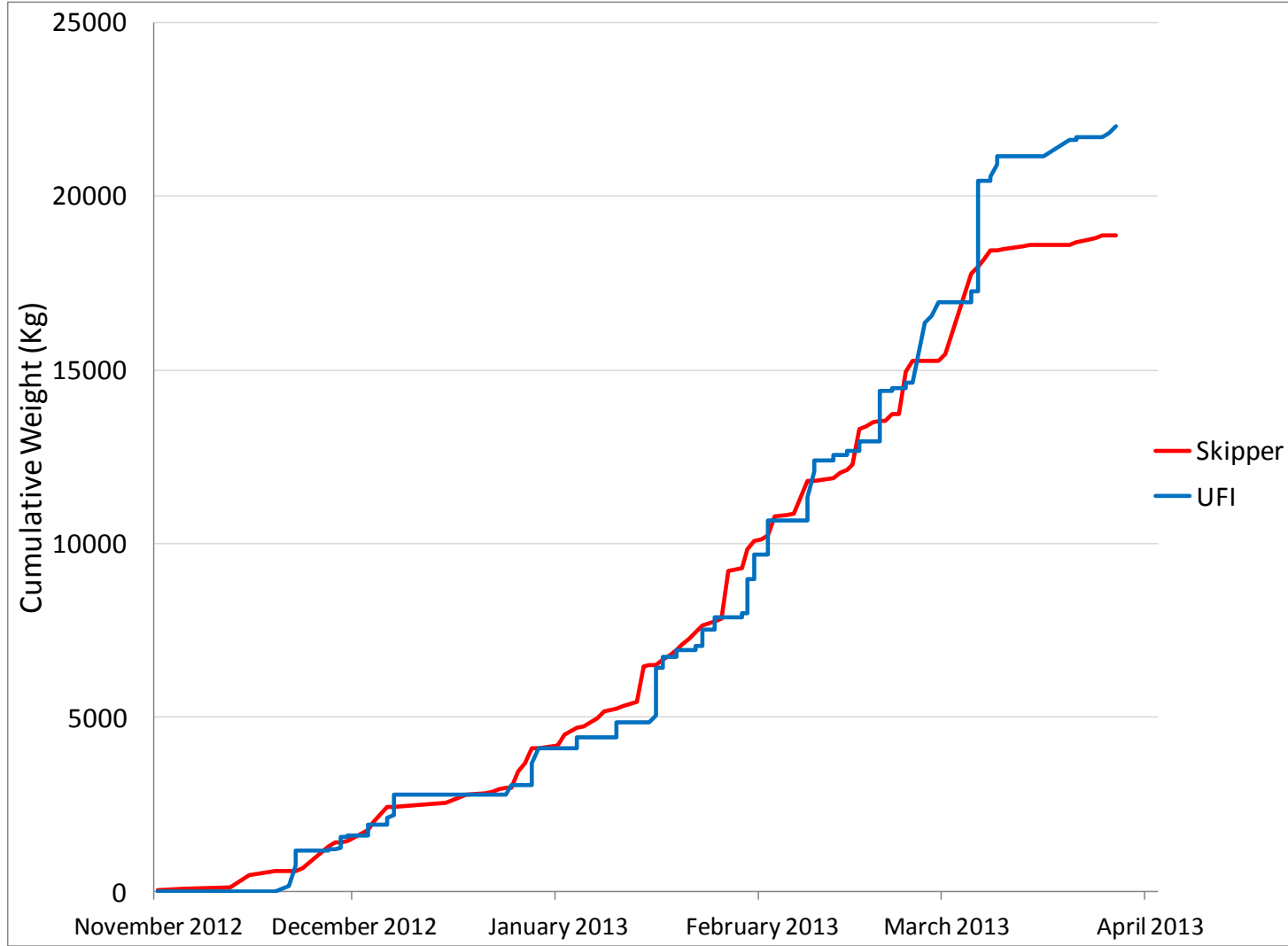


Figure 3. Cumulative weight of landed unwanted catches recorded by the skipper and received by United Fish Industries in Grimsby.

3.2.2 Catches of species released at sea

The weight of unwanted commercial species released at sea accounted for 30% of the total unwanted catch taken by vessels on the trial. Of the catch released at sea, 27.7% were considered not marketable, 68.8% were quota species and 3.5% were prohibited species which could not be landed under the conditions of the trial and had to be released (Table 3).

Species	Quantity Released	
	% Total	Total (kgs)
Spurdog**	49.23	4036
Dogfishes	25.66	2104
Undulate Ray**	14.22	1165.5
Porbeagle**	3.11	255
Mixed Rays	2.22	181.9
Common Skate*	2.06	169
Conger	1.93	158.25
Shad*	1.48	121.4
Brill and Turbot	0.09	7.37
Sole	<0.01	0.3
Total	100	8198.72

*Prohibited/**Zero TAC Species

Table 3. The composition of unwanted species released at sea during the discard ban trials.

The data from the skippers suggests that the mixed skates and rays, thornback rays and spotted rays, and to a lesser extent conger, brill, turbot, and (Dover) sole, were released because of a perceived high survivability. For the rays, skippers did not feel that restricted quota was the driver of discarding; rather the small sized of these fish were not marketable. This was also true of the brill and turbot released at sea; although there is no minimum landing size, they were below a minimum marketable size. The zero TAC species accounted for 96.7% of the released quota species. The over10 m netter caught the majority of the spurdog (4020kg/99.6%). This species has a tendency to aggregate in large numbers, and is difficult to avoid, when the vessel caught this species, it was caught in large volumes; it was recorded only on three fishing trips.

3.2.3 Landings of otherwise discarded catches

68% of the unwanted catches landed for fishmeal during the trial were of quota species; the Table 4 shows total weight of each quota species landed during the trial and a breakdown of the reasons for otherwise discarding these fish, as given in the skipper generated data. Data were collected on all species but only quota species are given here.

Overall, the majority of monkfish, hake, ling, pollack and saithe were unwanted because they were damaged (mostly by seals when caught in gill nets). All of the herring and horse mackerel and the majority of the mackerel were over the minimum landing size but were discarded because they were

not considered to be of marketable size. Skates and rays were also discarded because they were below minimum marketable size. Megrim were discarded due to quota problems, all of which from a single trip.

Where species were over the MLS, but not wanted, it did not necessarily indicate restricted quotas – for example two vessel operators said they did not have an issue with whiting quota and fish over MLS was considered to be not of marketable size. A similar pattern was observed for plaice. Had all these fish been counted against quota then it is likely the quotas for these species could quickly become restrictive.

Overall, 12,450kg of quota species were landed, equating to 97kg per trip. Based on the assumption that under a landing obligation, of these fish, all but the discards due to quota restrictions would have to come ashore, this equates to 68kg per trip.



Seal damaged hake in UFI storage bin

Species	Reasons for Discarding				Total (Kg)
	Damaged	Quota Restricted		No Market	
	%	%	Below MLS %	%	
Monkfish	100	0	0	0	414.0
Cod	47.5	52.5	0	0	3642.4
Dover Sole	0.9	1.5	97.6	0	68.0
Haddock	29.6	70.4	0	0	372.0
Herring	0	0	0	100	3.2
Hake	91.7	0	2.0	6.3	497.1
Horse Mackerel	0	0	0	100	65.2
Ling	100	0.0	0	0	792.0
Mackerel	0	0	1.0	99	41.2
Megrim	0	100	0	0	72.0
Plaice	0	40.9	42.8	16.2	3043.0
Pollack	99.6	0	0	0.4	722.6
Saithe	96.1	0	0	3.9	112.4
Skates and Rays	0	0	0	100	201.28
Whiting	3.7	10.7	12.7	72.9	2407.1
Total	35.51	30.11	13.54	20.84	12453.2

Table 4. Total quantity and percentage of otherwise discarded fish that were undersized, below marketable size, quota restricted or damaged by species

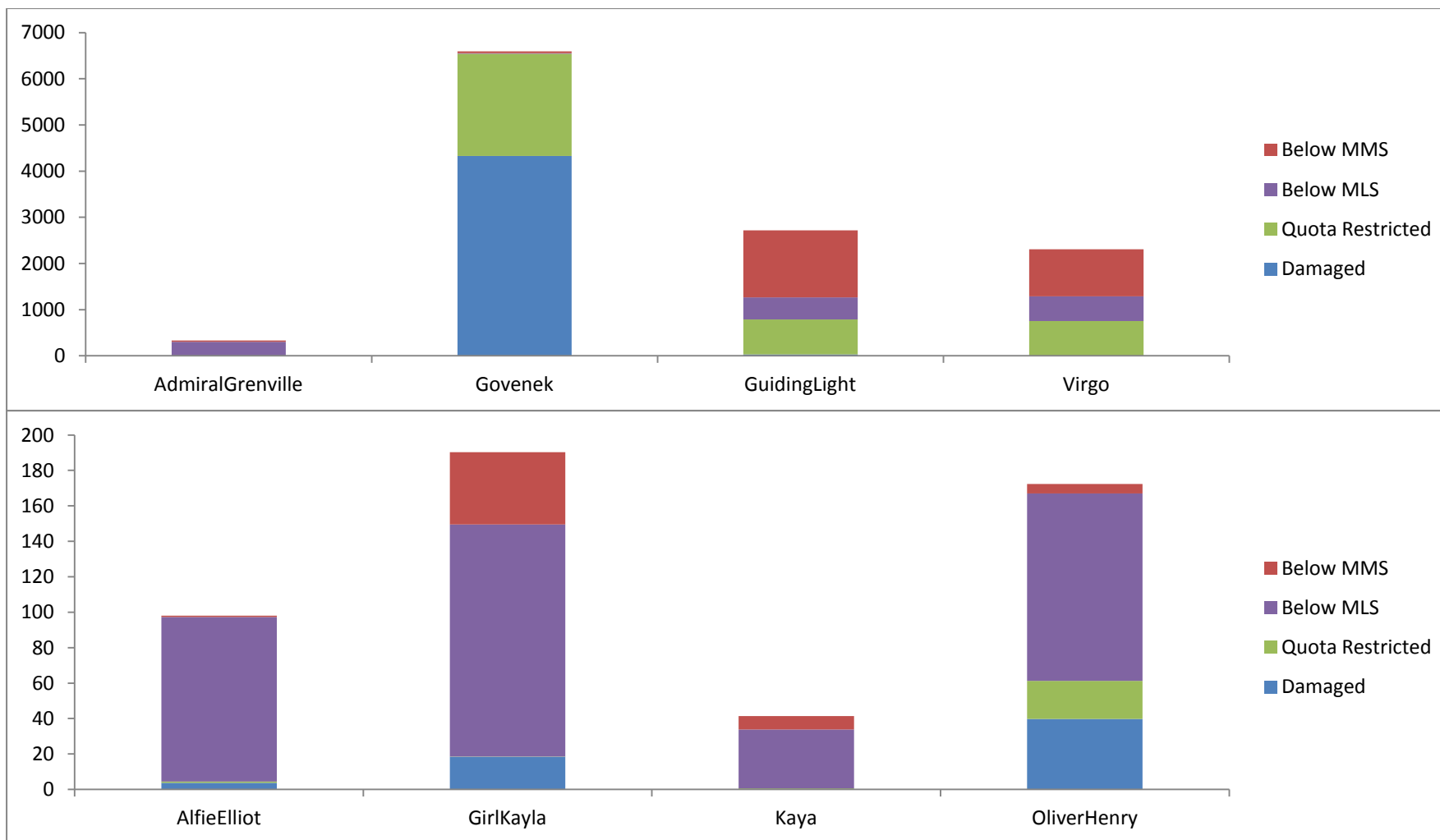


Figure 4 Weight of unwanted catches of quota species (kg) by the reasons for otherwise discarding these fish for each participating vessel. The under-10m vessels are shown separately from the over 10 m vessels because of the much smaller volume of discards.

Of the over 10m vessels, the beam trawler, MFV Admiral Grenville had the least discards by weight (Figures 4, 5, and 6). This vessel is well adapted to getting the most out of their catch and at the start of the project it was on the MMO catch quota scheme. A small volume of the catch was damaged by cuttlefish which mostly goes for bait. The catch that would have been otherwise discarded due to lack of quota was mainly undulate rays which have a zero TAC.

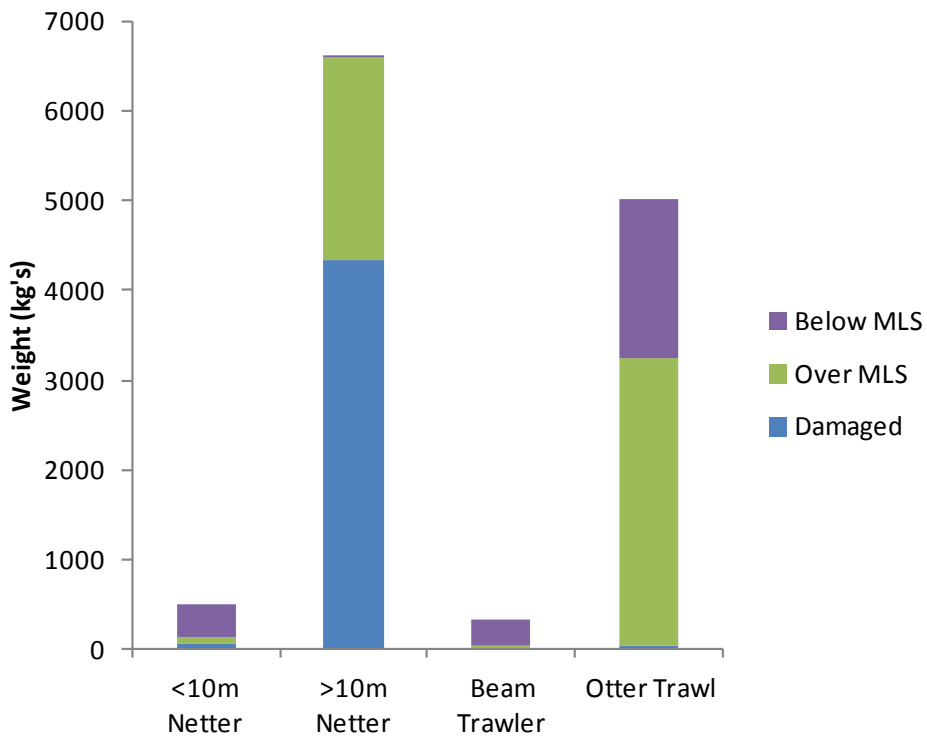
The over 10m gill netter, MFV Govenek of Ladram, had a major problem with seal and, to a lesser extent, lice damaged fish. This proportion of the catch would normally be discarded, but for the trials it was retained and landed. Overall, 67.5% of the otherwise discarded catch from the Govenek of Ladram was damaged by seals or lice; and of that, 89% was of quota species, mostly cod.

The other main driver of discards for this vessel was insufficient quota, all catches were over the MLS but the vessel did not have sufficient quota to land it all to the human consumption market. The owners did lease additional cod quota through an international swap during the trial, otherwise the amount of unwanted cod catch would have been substantially higher. Despite the leasing of additional quota, nearly 84% of the quota driven discards were of cod (Fig. 3), indicating that that this could be a choke species for this vessel and this fishery. All Zero TAC species caught during the trial had to be returned to the sea. There is a zero TAC on spurdog and the high incidental catches of this species were noticeable for the Govenek of Ladram. The status of zero TAC species within the discard ban is unclear and clarification is needed on how the new regulation will be interpreted in the case of catches of spurdog and other zero TAC species.

For over 10 metre otter trawlers, fish with associated quota which were over MLS represent a large portion of discards, mostly whiting and plaice. This could indicate that quota restriction as the main driver, however, when asked, the skippers made clear that these fish were discarded because they were below a minimum marketable size. The driver for discarding for these vessels was a combination of the selectivity of the gear and the size at which the fish (plaice and whiting) become marketable. Nonetheless, if all these fish were to be counted against quota, continued catches of this size class of fish would utilize quotas much more quickly, therefore it is in their interest to modify the gear to be more selective.

The catch and sorting patterns were consistent for all of the under 10m netters. The unwanted catches were dominated by plaice and whiting, which would otherwise have been discarded because they were under the MLS or damaged. Vessel operators stated that discard patterns can be quite different at other times of the year, in particular quota driven discards of cod (section 3.7).

a) Quota Species



b) Non-quota Species

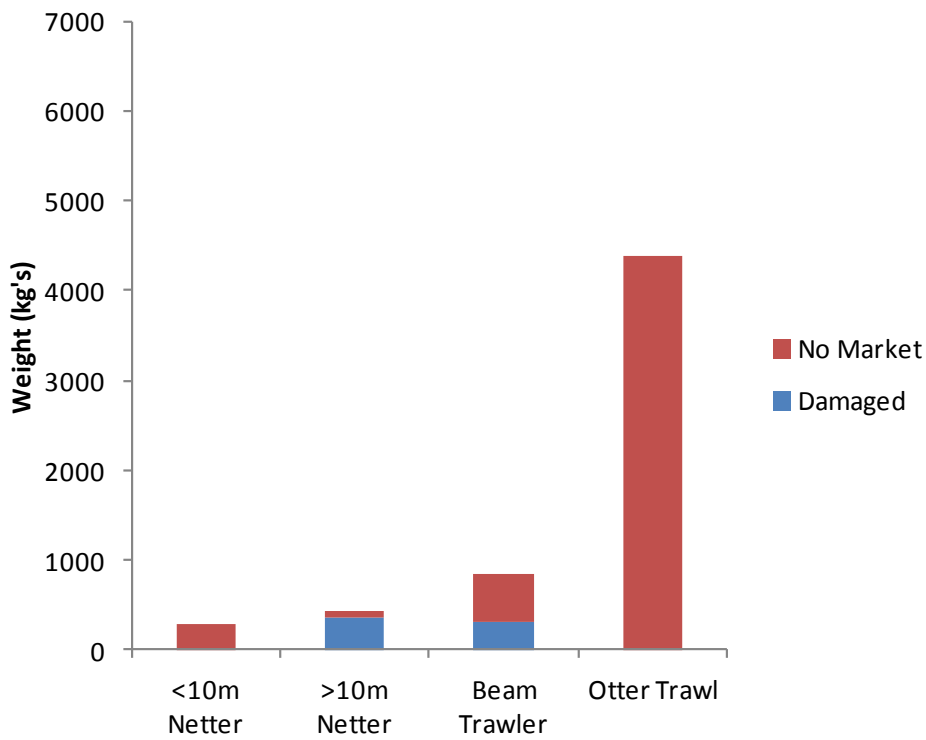


Figure 5: Reason for discarding by gear type

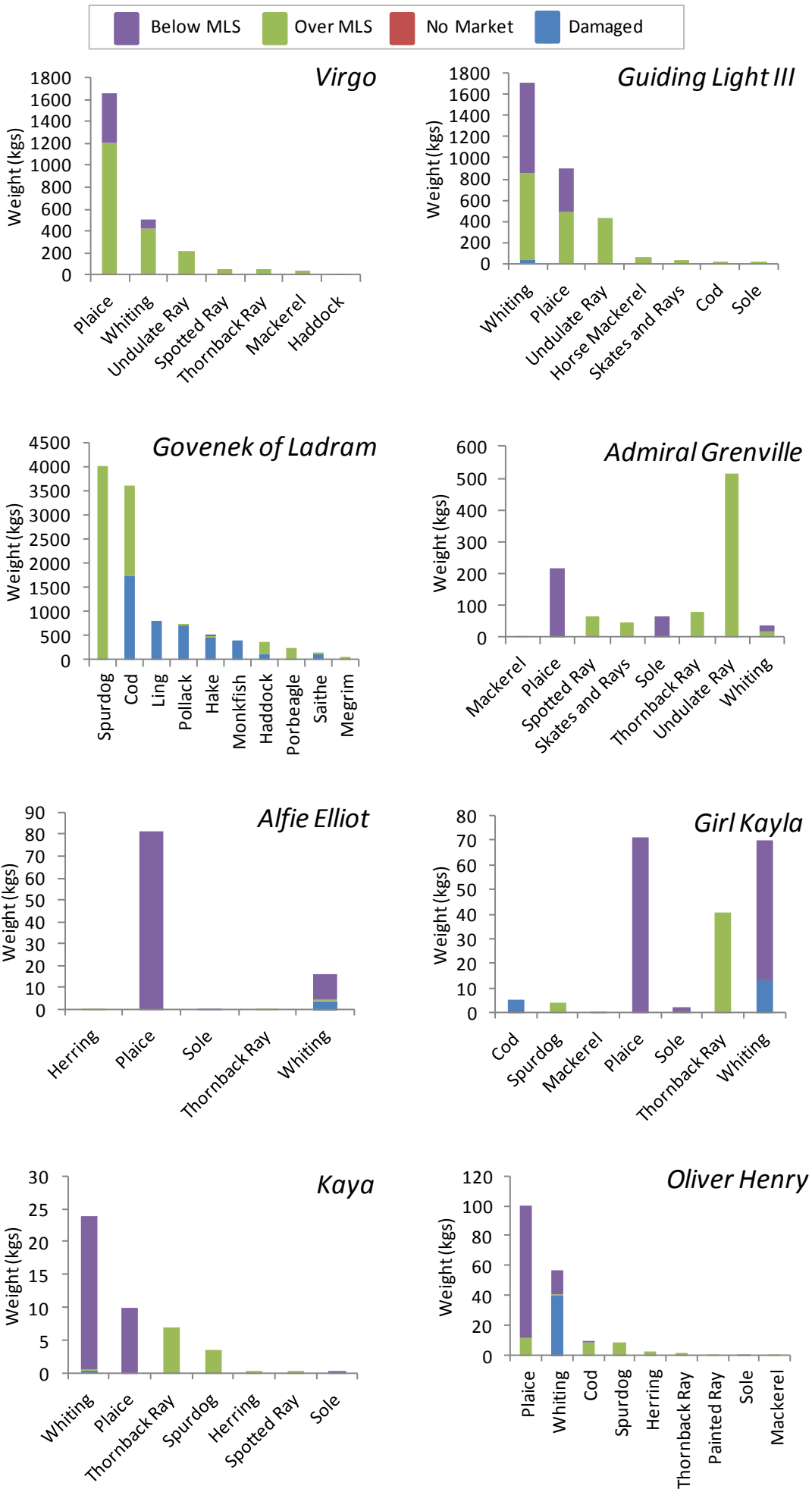


Figure 6: Top ten quota species discarded by vessel and the reasons for discarding

3.3 Observations onboard handling, sorting and storage of catch

Fisheries observers recorded their observations during fishing trips onboard the participating vessels. Overall, the levels of catches retained onboard that would otherwise have been discarded were considered higher than would have been expected following the implementation of the discard ban. Vessel operators would be motivated to avoid catching unwanted quota species and would not be landing non-quota species. The MFVs Virgo and Guiding Light are both over ten metres fishing with otter trawls, Virgo is fitted with a Hopper and Guiding Light is fitted with a conventional fish pound. When the catch was brought on board, it was deposited in the fish pound or hopper before being sorted. During the trial, the crew would pick out the marketable fish which they would normally keep and the commercial species they would normally discard. After the marketable catch had been sorted and gutted, the unwanted catches were picked out and separated to species level, to enable weight estimates by species (Table 6).

The amount of space in the fish room differed between these two trawlers; with Virgo experiencing limited space while Guiding Light having sufficient space. Instead of storing each discarded species in a separate fish box, Virgo mixed the discards once they weights had been estimated, and stored them in as few boxes as possible in the fish room alongside the marketable catch. The skipper of the Virgo had to take on additional boxes during the trial in order to store the unwanted catches. On a few occasions during the trials, by-catches of smooth hounds were high. These catches filled the hopper and once sorted there was no room in the fish hold to store the discards, so the skipper had to keep them on deck, restricting the working space on the vessel. Smooth hounds are non quota, and therefore would not be landed under the landing obligation. Onboard both vessels, crew took longer than normal (sometimes in excess of two hours) to sort, process and weigh the catch.

On board the Govenek of Ladram, the over 10 metre netter, the crew handled the catch in the same way as they would under normal fishing operations. Normally, the nets are cleared of all fish regardless of whether the fish are to be retained or discarded as they come aboard. The fish are sorted into species and stored in boxes un-gutted. The capacity of the vessels fish hold was 500 boxes. During the last two trips, the vessel took onboard the UFI storage bins to store the unwanted catches. Handling the unwanted catches was estimated to take one additional hour each day and up to two hours during landing.

The Admiral Grenville, the over ten metre beam trawler, had Remote Electronic Monitoring (REM) onboard at the start of the trial because it was participating in the MMO catch quota trial scheme. The vessel however, left the catch quota scheme soon after the discard ban trial started; therefore, no REM data were available to compliment this trial. By retaining onboard all of the otherwise discarded catch during the trial, the Admiral Grenville reached its fish hold capacity on one of its trips and was required to land prematurely after three days into a scheduled seven day trip. In order to maximise space in the fish hold, the crew needed to stack boxes up to nine high, it was recognised that this increased the health and safety risk for the crew. This reduced their fishing time in this trip by up to twelve hours for the trip, as well as incurring extra transport costs. However, the material that would have otherwise been discarded was mostly of small gurnards and because these are not subject to catch limits, they will not have to be landed under the new CFP. The Admiral Grenville was expected to have sufficient hold space to land all catches of the currently discarded quota species.

The four under-10 metre gill netters from Hastings, Alfie Elliot, Girl Kayla, Kaya and Oliver Henry, all opted for full observer coverage during the trial. Onboard, the skippers sorted the catch into two categories; fish which would be sold for human consumption and fish which would be sent to the fishmeal factory. Due to restricted space on deck and a shortage of boxes and baskets the vessel could carry, the crew were unable to sort the catch into separate species on board the vessel. A Cefas observer independently collected data about the fishing operation and all components of the catch.

Table 6: Summary of observation on vessels in the trial showing the changes to fishing operation, catch handling and other changes as a result of retaining all catches on board.

Vessel	Vessel and gear description	Fishing operation and catch handling	Changes due to retaining discards on-board
Virgo	Single rig stern trawler Hopper	Discards were sorted by species, measured and placed in one box and stored in the fish room in a separate area to the marketable catch or on deck	Limited space in fish room Required extra boxes to put discards Crew spent longer than normal (>2 hrs) to process catch in deck
Guiding Light	Twin rig stern trawler Conventional fish pound	Discards were sorted by species, measured and placed in one box and stored in the fish room in a separate area to the marketable catch	Plenty of space in fish room Skipper sold most of the discards for pot bait to maximise revenue Crew took longer than normal to process catch on deck
Govenek of Ladram	Over 15 m gill and tangle netter	Similar to normal fishing operations	Handling the unwanted catches took an extra one hour each day and then an additional two hours during landing.
Admiral Grenville	Beam trawler, left Remote Electronic Monitoring (REM) catch quota trial scheme at start of discard ban trial period	Discards were sorted by species, measured and placed in one box and stored in the fish room in a separate area to the marketable catch	Had to stack up to nine boxes high to maximise space in fish room Reached hold capacity due to retaining non-quota discards onboard (mid-trip landing and reduced their fishing time)
Alfie Elliot, Girl Kayla, Kaya, and Oliver Henry	Under 10 m netters	Restricted space on deck to house balanced scales. Shortage of boxes and baskets the vessel could carry Crew unable to sort the catch into separate species on board the vessel	Cefas observer collected data on fishing operation and all components of the catch. Skippers did not want to estimate weights of small quantities of fish while at sea



Sorting the catch on inshore netter Alfie Elliot

© Cefas



3.4 Economics of landing material for fishmeal

The costs of running the trial were covered through funding from Defra and European Fisheries Fund (EFF). The vessel operators paid for their normal fishing expenses (fuel, market dues, crew share etc) related to the catch that was destined for human consumption while the project paid for any extra expenses (box rental, ice, storage and transport) incurred by the landing of the unwanted catch. Most of these expenses were paid as a one-off, e.g. to the transport company. The cost of landing the unwanted catches to the fishmeal plant is given in Table 7.

All catches of quota species had to be utilised as fishmeal, as a condition of the trial. However, under the discard ban industry will be able to access a range of non-human consumption markets to maximise profits from the previously discarded catch. The expenses related to landing, storage and handling of unwanted catches differed between vessels and landing ports. For instance, only one out of the eight skippers required extra boxes so that he could land his entire catch. Fifty boxes were hired for him each week at £0.50 per week totalling £400 for the duration of the trial. Similarly, Brixham charged for forklift, fridge and pallets for the unwanted catch at a total cost of £450, Hastings also charged for storage (£432) and loading (£350) of boxes during the four months.

Table 7: Summary of costs incurred to land, store and transport unwanted catches for processing by United Fish Industries (UFI) into fish feed showing the revenue that was generated from unwanted catches.

Cost/revenue	Measure	Total
Skipper estimated weight	Kg	19,017
Cost	Box rental, £	400
	Box storage on market, £	432
	Box loading (out of office hours), £	350
	Forklift, fridge and pallet charge, £	450
	Ice, £	182
	Bin transport, £	3516
Total cost	£	5330
UFI weight received	Kg	22,000
Revenue from discards	£	2640
Difference	£	-2690

Apart from the four vessels from Hastings that did not use ice to keep the catch chilled during fishing, all other vessels added ice to the fish boxes before landing. Ice was also used to keep the discards chilled in the storage bins once at the landing port so as to maintain quality. In total, around 3.8 tonnes of ice were used during the trial at a total cost of £182. The highest cost was in transporting the unwanted catches to the fishmeal plant. Transport of storage bins from the landing ports to the UFI plant in Grimsby cost £3,516 during the trial.

In total, £5,330 was spent on landing and transporting the unwanted catches for processing at UFI during the four month trial by the eight vessels. While these costs were covered by the project, they give an indication of the additional operational costs for vessel operators in landing their previously discarded catches for fishmeal. Given that the total revenue of the material received from UFI was £2,640, then the unwanted catches were sold at a loss of £2,690 or £122 per tonne. Only a single figure estimate is given here that is specific to the group of participating vessels. The main aim of the trial was to explore the practicalities of the discard ban, and we have presented the costs as they were incurred (i.e. one-off payments). Distributing the costs over the duration of the trial or by the number of vessels or ports would be misleading since some costs e.g. box hire were not spread across the vessels that took part. Similarly costs for forklift, fridge and pallet charges were only required for Brixham and not at the other ports.

To use this as an estimated average cost for all vessel operators landing material to the fishmeal market would assume that the group participating vessels is representative of the wider fleet. Further analyses would be required to uphold this assumption based on the quantities and point of landing of otherwise discarded fish for the whole fleet and other market service charges. Moreover, the estimate provided here could be considered to be a maximum for the participating vessels owing to several factors:

1. The ports selected were some of the furthest away from a fishmeal plant, therefore transport costs would be less from other ports
2. The quantities being transported did not allow for the most efficient use of lorries with storage bins being moved that were less than full; when operating on a fully commercial basis, it is likely that storage bins would only be transported when full
3. The scale of the trial was too small to allow for the most efficient use of catch handling services; because it was a trial, one-off costs were paid to markets to deal with the material, which were higher than would be expected following implementation
4. The previously discarded catches have a financial value and it is likely that improved efficiency in handling and transport, and increased competition for the material would evolve and so improve returns to the vessel operators

There are companies that could potentially collect and store material until sufficient quantity has been accumulated to make transport viable. For example, the Western Fish By-products company was identified, which collects and stores offal and fish material in cold stores to supply to the UFI fishmeal plant. There are currently regular deliveries from Western Fish By-products, based in Newlyn, to UFI in Grimsby. This is a business model that could be increased or replicated to provide sufficient storage. Additional transport was arranged and paid for through the trial but there are currently direct transport links to UFI Grimsby from the northwest and northeast England (as well as other routes supplying the Scottish UFI plant).

UFI is currently working to about 50% of capacity due to the levels of material the plant can obtain and there remains a strong market for fishmeal and fish oil. There is some uncertainty over how much additional material destined for non-human consumption might come ashore with the implementation of the discard ban. The extent to which vessel operators can adapt fishing methods and alter their catch compositions is not known. With the potential for various exemptions also it is difficult to predict the levels of material and

therefore the level of investment for additional infrastructure required. (transport, storage bins, physical space, freezers, cold stores, fishmeal processing plants etc). There will be numerous markets for the previously discarded material, but there is a risk that given the uncertainty, inadequate preparations will have been made to handle the previously discarded material. Other potential outlets for the material were mentioned, for example, the pet food and mink feed, for which there is a substantial demand in Denmark.

3.5 Markets for otherwise discarded catches

Although, in this trial all otherwise discarded quota species had to be utilised as fishmeal with the implementation of the discard ban, other outlets for the material are likely to be utilised, either generating a profit or reducing the losses incurred. Three vessel operators (Virgo, Guiding Light and Admiral Grenville) tried to sell unwanted catches of non-quota species as pot bait rather than for fishmeal. These included gurnards, smooth hounds and bibs. By using the market for pot bait, they could potentially earn more from the material than sending them for fishmeal. For instance, the fish sent to UFI for fishmeal sold at £0.12 per kilogramme while bait at Plymouth and Brixham fish markets was selling at £0.20 per kilogramme (£200 per tonne).

The trial was conducted during a period when there was little fishing activity by potters and the market for pot bait was limited. The low demand for pot bait resulted in most of the material being sent for fishmeal. The shellfish potting effort is highest during the summer months, it would be expected that there would be considerable demand for previously discarded catches for pot bait during this time.

Managers of Plymouth Trawler Agents (PTA) stated that outside of the trial, there is material that cannot be sold on the human consumption or bait markets, and there is also offal generated at the market. This material is disposed of at a local anaerobic digestion unit in Holsworthy. PTA currently pays for material to go to the anaerobic digestion unit at the cost of around £30 per 400kg (£75 per tonnes). The equivalent cost for storage and transport of unwanted material by BTA was £27 per bin of ~400kg (£67.50), and this cost was transferred to the vessel operators who landed the material.



3.6 Perceptions of skippers and market managers

3.6.2 Changes to normal fishing practices

The data generated for each vessel were shown to the skippers. The skipper of Virgo agreed that the species he discards most were plaice, dab, whiting and lesser spotted dogfish. He stated that during the trial the market for pot bait was poor, because many of the small potting vessels were either undergoing refit or being hampered by poor weather. At other times, he would expect there to be a stronger market for pot bait. The skipper stated that the composition of the landings is dominated by non-quota (non-pressure) stocks, which make up around 80% of the landings.

Although the data were representative of fishing at that time of the trial, there are three main fishing periods during the year, each lasting around one third of the year. These fisheries target lemon sole, squid and cuttlefish in different areas. The discard ban trial was conducted during the lemon sole season and the discard patterns would expect to differ when targeting squid and cuttlefish. The skipper indicated that in the months when he fishes offshore, discard rates can reach 0.75 tonnes for a three-hour haul, with small flatfish making up the bulk of the catch. This could create difficulties in storage and stability (safety) of the vessel. No change in fishing practice was made during the trial and no attempts were made to avoid unwanted catches or to market any more of the catch than was usual.

The skipper of Guiding Light agreed with the data and stated that he had practiced normal fishing activity during the trial. He had not sourced any additional quota to land all marketable catch as it was early in the year and quota was not restrictive. The skipper also confirmed that no additional fish went onto the market than usual. Plaice that were under MLS (27cm) were generally mixed with unwanted plaice which were under the marketable size (27-30cm). These fish were not considered to have been discarded due to quota restrictions but instead for market reasons.

The skipper explained that this was similar with whiting, but unlike whiting, the quota for plaice became restrictive for a period. There was no market for bait at the time of the trial as there was little fishing from potters, but in the summer more would have been sold as pot bait. The trial took place during the lemon sole fishing season. At other times of the year fishing focuses on cuttlefish and for a two month period, squid.

Skipper of the Govenek of Ladram said that he has changed his fishing patterns recently with the introduction of recent management measures. There was a commercially viable common skate fishery, however, this species is now prohibited and can no longer be landed; and due to the restrictive quota for cod, he targets turbot, monkfish and hake, which means he is effectively operating in only one fishing area. The geographical concentration of fishing effort from this vessel and others in this fleet in the same situation was considered to have exacerbated the level of seal damage to the catch. The main reasons for discarding was agreed were quota restrictions and seal damage.

The monthly quota allocation for cod for the Govenek of Ladram was 1 tonne, and although the fishing operations were consistent with normal practice, the vessel owner used the payments from the trial to lease 15 tonnes of cod quota so that this fish would not have to be sent for fishmeal. Therefore, the landing and discard pattern were not representative of normal practice. Discard levels for cod would have been

considerably higher under normal fishing conditions. Similarly, the vessel owner was able to lease additional haddock quota (10-12 tonnes) to supplement the monthly 200kg allocation. However, a cut in the TAC and the difficulty in finding species to use in swaps are making the acquisition of haddock quota more difficult.

The skipper of Admiral Grenville retained undersized and under marketable sized non-quota fish which he sold to the market as pot bait through Plymouth Trawler Agents (PTA). No additional fish sizes or species went onto the market than would have normally done so. During the trial, the Admiral Grenville worked on the usual fishing grounds and used normal fishing gear with one exception.

When the vessel was targeting cuttlefish, which was for about one third of the trips during the trial, the capacity of the fish hold became exhausted and the vessel was required to split the trip and perform an additional landing. Normally, Admiral Grenville would fish for seven days, on these split trips the fish had to be landed every four days. Usually when fishing for cuttlefish, the small fish, otherwise landed for the bait market is not retained and the fish hold space is reserved for cuttlefish only. The result of these split trips was an additional fuel cost and a loss of 18 hours of fishing for each additional landing event. The Admiral Grenville has a smaller fish hold compared to similar vessels in the company fleet. However, the fleet manager stated that similar vessels would have also exhausted their hold capacity if the same level of fish had to be retained onboard. It was agreed that had the vessel been required to retain only the unwanted quota species the problem would have been much reduced.

The skippers of Alfie Elliot, Girl Kayla, Kaya, and Oliver Henry were shown data from their vessels and interviewed as a group. The skippers believed that the data collected were representative of their fishing but only of the period of the trial. The catch and discard patterns would have been quite different had the trial run at another time. Compared with previous years, the monthly quotas, particularly for cod were available in sufficient quantity, during the months of the trial, to allow for this fish to be landed. Therefore, quota driven discarding was considered less than in previous years. The skippers of these vessels stated they did nothing different to their normal fishing practices during the trial. The skippers stated that starfish can damage fish caught in the nets, and while this material would normally be discarded, if it had to come ashore it could go onto the human consumption market at a reduced price rather than to industrial use. Furthermore, whiting above MLS were discarded due to an absence of market rather than quota restraints.



Guiding Light III landing the catch

© Cefas, Tom Catchpole



Kaya landing the catch

© Cefas, Tom Catchpole

3.6.1 Practical constraints once unwanted catches were landed

The process of landing the catches took longer for all vessels in the trial. At several fishing ports, including some in the trial, vessels can sometimes have to queue to land their catches. Having to land more material will exacerbate any congestion at the point of landing. The relatively restricted size of the fish hold of the Admiral Grenville meant that the landing process was slowed down considerably as only two boxes at a time could be landed until sufficient space had been cleared for larger stacks to be lifted out. When the fish hold is at capacity it was estimated to take an additional one hour to land the catch.

At the start of the trial the storage bins were all numbered and put on a rotation for specific ports. However, some of the bins were not returned to the correct port resulting in a surplus of bins in Plymouth and none in Brixham. In some instances, the otherwise discarded material was frozen and stored until it could be collected and sent for fishmeal. The delivery system was improved with each of the bins given a unique code including the name of the designated port. Transport for the unwanted material to the UFI plant in Grimsby from each landing port was pre-arranged. The relatively large markets in Newlyn, Brixham and Plymouth always had staff available to load the storage bins onto the lorry. However, in Hastings, a much smaller port, arrangements had to be made for a member of staff to allow access and load the lorry with a forklift truck.

UFI managers recognised that one of the key considerations during implementation of the landing obligation is having sufficient number of bins to hold the material at the ports, and having them in the right ports. The expected logistical complexity of rolling out the system is paralleled by the complexity in tracking from which vessel the material originated from and ensuring payments were made correctly. This would be particularly challenging in small ports.

In all of the markets in the trial, Plymouth, Brixham, Newlyn and Hastings the market managers were willing to take part in the trial. In Hastings and Brixham (BTA), payments were made for additional labour generated by the trial. Although no charge was made by Plymouth (PTA) and market employees were extremely helpful in handling and moving this material, it was recognised that this required additional labour and the cost could not be absorbed by PTA when the landing obligation comes into force. Market managers stated that there was a need to clearly separate and identify the different components of the landings, to denote whether it could be sold on the human consumption market or not.

A call in system from the vessels enabled project staff to arrange transportation of the material to Grimsby. Vessel operators were asked to text or call Cefas staff when they landed and provide the weight of material and the bin number. Cefas then contacted the transport agency and arranged for the bin to be collected. Cefas also contacted UFI to tell them a bin was on the way and provided an estimated weight of material. At the point of arrival of at UFI in Grimsby, each bin was weighed and records were kept of all of the material received. Information on the weight of material was used to determine payments made to each vessel



Brixham fish quay, forklifts

© Cefas, Tom Catchpole



Quayside transport picking up material from Brixham

© Cefas, Tom Catchpole

operator. There were two occasions when the call in procedure broke down, and storage bins were left on the quay and the material started to spoil. All material from the trial was utilised by UFI, however, the considerable effort to achieve this was noted.

In Newlyn and Plymouth, it was relatively easy to find a place to store the bins needed for the trial. In Plymouth the bins were stored in a corner of the market hall, while in Newlyn the bins were stored outside the market on the quay. The storage bins were collected daily from these two ports. In Brixham, the bins were kept outside the market as they could not be stored with the fish destined for human consumption. In Brixham it took 3-5 days to fill the storage bins, only then, were they transported to Grimsby. This did not present a problem during the trial, which took place during the winter months, when temperatures were low, but during the summer months the fish would likely spoil much more quickly if left outside. With the implementation of the discard ban, unless additional refrigerated storage was provided, bins would need to be collected from each site on a daily basis. Moreover, many more storage bins would be required than the number used in the trial. A key observation of the trial was the difficulty in accommodating sufficient a number of storage bins at even the largest of the fish markets.

The managers of Plymouth Trawler Agents, when predicting the impacts of a roll out of the discard ban, noted that up to 120 vessels can land per day into Plymouth. If each vessel had 3 boxes (120kg) of unwanted material, there would be a requirement for 30 storage bins to be onsite and picked up and replaced each day, each bin requiring storage space and ice. The question was raised, who is going to pay for this additional work, ice and transport, and where would this material be stored. When the market is busy there is no spare capacity in the chillers. It was stated that there are 700 fishing vessels that land into Plymouth, around 250-300 of the vessels are regular visitors. PTA representatives were clear that they did not want the additional burden of handling or recording this material, because any profit margins for this material are marginal at best. However, behavioural changes and increases in selectivity should result in reduced catches that need to go fishmeal and other non-human consumption markets.

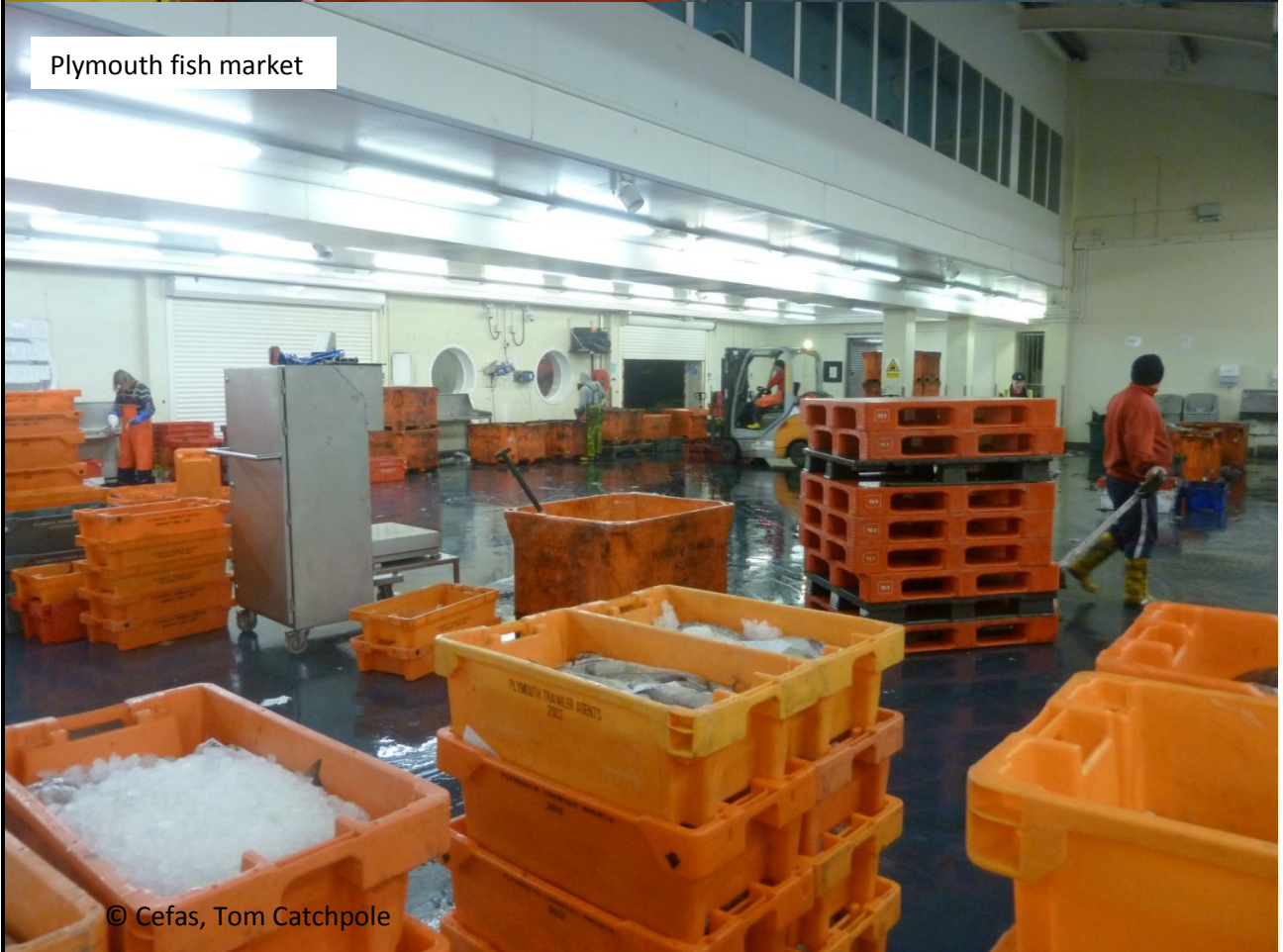
Similar, points were made by the one participating vessel operator who, when looking ahead to the roll out of the new policy, noted that up to 150 landing events can take place in a single day at Plymouth. He suggested that if only one box of unwanted fish were brought ashore with each landing (even as a gesture toward compliance with the discard ban) this would equate to 7.5 tonnes of material or 15 storage bins that would need to be stored, transported and processed. It was made clear by participants that it would be essential to assign the responsibility to someone at the point of landing for the material destined for non-human consumption outlets.

Accommodating the storage on the market site at Brixham was also considered to be extremely difficult. BTA managers have recently looked to use bins as a more efficient way of handling cuttlefish, however, it



Plymouth fish market

© Cefas, Tom Catchpole



Plymouth fish market

© Cefas, Tom Catchpole

was decided there was insufficient space on the site. During peak times, there is nearly 90 tonnes of fish being landed in one day; and assuming an additional 10% of this is landed as non-human consumption material, this would fill 20 bins per day, which would need to be removed and replaced each day (enough to fill one articulated lorry). The market managers did not want to risk any deterioration in the quality of the fish going on the human consumption market, and would consider small unwanted fish entering the market as a negative impact on their business. There is a desire to 'push up quality of fish and we do not want low value fish on the market'.

Other nearby smaller ports were also mentioned. In Mevagissey, the port is restricted to vehicles weighing no more than 7.5 tonnes. There are 15 vessels that off-load their fish at Mevagissey, which could mean the need for one or two additional vehicles. In Polperro, lorries cannot access the quay at all, here a forklift truck is used to transport fish into the town to a waiting lorry. The landing of unwanted material to these ports would come at increased additional cost and time. The question was raised, is it feasible to have storage bins in each port. The Govenek of Ladram landed into several different ports, not all could be prepared by the project team, and over-loaded the catch to the most suitable fish market. When the vessel landed abroad (France), the skipper took the responsibility for ensuring the unwanted catches were disposed of in the correct manner.

The skippers of the under 10 m vessels in Hastings noted that, if all the local fleet brought ashore their undersized fish, there would be a need for more refrigerated storage facilities at Hastings. Bin storage on Hastings market was not easy and therefore space in the refrigeration unit where the bins were stored had to be rented for the duration of the trial at £60 per week. The walk in chiller was quite small, with floor space of approx 12m² and the Hastings market authority therefore requested smaller (660 litre) instead of the large (1000 litre) bins originally supplied. It was thought that an additional and separate 'chiller' facility would be needed to store the material. There were also concerns over the impact of maintaining the Environmental Health certificate at the market facility. The skippers stated that the chillers should ideally be cleared everyday to ensure the hygiene standards are maintained and the best price can be achieved for the material.

Due to the small volumes of discards landed at Hastings during the trial, the storage bins were not filled quickly. The bins were therefore collected on a weekly basis, regardless of how much fish was in them. This meant that the storage bins collected from Hastings were between 43 - 66% full which implies that on average, the material from Hastings were worth £19 per bin but cost £51 to send to the fishmeal plant in Grimsby making a net loss on each bin of around £32.

In general, there was no commercial interest from the markets for the unwanted material as they considered that it would lower the overall quality of the fish being landed at the market and would provide little or no economic return. The managers of the markets made clear that they did not want the responsibility for handling and transporting the unwanted material. Some skippers observed issues with security of the storage bins, with some fish being removed to be used as pot bait. In Hastings, this meant that the storage bins had to be locked.



Mevagissey harbour, Cornwall

Polperro harbour, Cornwall



3.6.3 Identifying potential 'choke' species

The principles of catch quotas were discussed with each of the skippers and market representatives. The skipper of *Virgo* stated that under the catch quota regime, the most restricted species would likely be plaice then haddock, and to a lesser extent, Dover sole. The skipper does not target any of these species but recognises that any of them could easily force a premature end to his fishing season. *Virgo* is an over 10 m non-sector vessel that receives a monthly quota allocation for each species, and the level of allocation differs from the under 10 m non-sector vessels. The total quota of three tonnes of haddock per year for all over 10 m non-sector vessels indicated the potential for this species to act as a choke.

Quota distribution and quota access will be very important if substantial adverse economic impacts are to be avoided with the reformed CFP. An important part of this will be how the quota uplift is utilised. It was suggested by the skipper of the *Virgo* that quota uplifts should be based on a vessels historical catches. However, there are many other options that need to be considered. A major concern of the skipper is the inadequate level of quotas and their inflexibility which makes it difficult to match quota and catch composition. The skipper of *Virgo* suggested that monthly quota allocations should be more flexible so that they can be used when the fish are being caught and all of the non-sector quota should be utilised.

Since this trial was conducted, it has been agreed that non-sector vessels can lease quota to reduce discards of marketable fish. However, the quota allocated to the vessels cannot be leased out. For sector vessels (those associated with a PO), there is more flexibility and opportunity to match quota availability and catch composition. The skipper of *Virgo* recognised the benefits of being a member of a PO, and had made an approach to a Producers Organisation. However, skippers must buy into a PO and even with the current track record and quota holdings the cost of joining was prohibitive. The skipper suggested that it should be made easier and more advantageous for non-sector vessels to join Producers Organisations (POs).

The skipper of *Guiding Light* indicated that he would expect to lease haddock quota so that he could land all of the marketable fish under the discard ban. The skipper of *Guiding Light* considered haddock to be the most restrictive species, followed by cod, monkfish and plaice. However, he generally catches non-pressure stocks and therefore believes that the new discards ban policy will not have a large effect on his business. The skipper of *Govenek of Ladram* stated that his major problem during the transition from landings to catch quotas was the amount of cod quota. He stated that his and similar vessels in the fishery could catch their monthly allocation for cod in two days; changing fishing methods to avoid cod to the extent possible and having a quota system that is sufficiently dynamic to make available the quota where it is needed could mitigate the risk of an early closure.



Haddock landed onto Plymouth fish

© Cefas, Tom Catchpole



Plaice landed onto Plymouth fish market

© Cefas, Tom Catchpole

The Govenek of Ladram is one of 12 over 15m netters currently in the south west of England. Under a landing obligation the expectation of the skipper was for the price of quotas, to buy or lease, to increase considerably. He noted that, under current system, if all seal damaged fish were landed and deducted from a catch quota the PO would rapidly run out of quota for cod and monkfish, with knock on effects to other vessels in the Cornish Fish Producers Organisation.

The skipper of the Govenek of Ladram also highlighted the importance in how the zero TAC species would be dealt with. These are quota species, and so would need to be landed, but with a zero quota and no uplift or exemption, as it stands now, if a single fish was caught it could end fishing for the year. It was stated that the fishing method used by this fleet was one that delivered high fuel efficiency, low CO₂ emissions and high selectivity with low catches of juvenile fish and it also had a low impact on the seafloor. This is a fishery, considered by the skipper, to be more sustainable than other fishing methods and this should be taken in account by fishery managers in the allocation of quota.

The skipper and the manager of Admiral Grenville said that most of the discards generated by their vessel are of undersized fish. Admiral Grenville is one of a fleet that operates within a company which is also a Producer Organisation. The PO has four beam trawlers each with associated quota holdings which provide sufficient flexibility to avoid any quota driven discarding. It was thought the vessel would be unaffected during the transition to the landing obligation, based on the assumption that the level of uplift to the current landing quotas is in line with current estimates of discarding. Moreover, the estimated discard patterns are representative of the actual fishing practice.

The skipper highlighted that where this might not be the case was with area VIIe plaice, where the discard rates on the inshore fishery are considerably higher than the overall assessed level. Without additional plaice quota above the current estimated discard levels, this would act as a choke species, and it is likely that the vessels would not fish on the inshore grounds. This situation was considered a result of insufficient data to assess fine scale differences in discard patterns. The skipper and fleet manager concluded that it was data deficiencies that were the highest risk in the transition to catch quotas and the landing obligation, whereby underestimating discard levels would provide an insufficient uplift in quota to enable the vessel to operate for the full year.

The skippers of Alfie Elliot, Girl Kayla, Kaya, and Oliver Henry had expected that over quota fish, particularly cod would be an issue in their fishery during the trial. The trial was due to start in December, a time which is historically low in quota allocation but high in cod catches. However, due to the time taken to agree the terms and conditions, the trial didn't start until February by which time the cod catches were relatively low and the quota allocation was unusually high. Therefore, although the skippers were aware that cod would likely be the main choke species, the timing of the trial meant that this was not apparent in the data generated. Moreover, because an observer had to be onboard for each trip during the trial, the number of days of data and observations were lower for these vessels than the others in the trial.

Over-quota cod catches from Govenek of Ladram



© Cefas

3.6.4 Potential for selectivity improvements and survival of discards

The skipper of Virgo released all of the unwanted lesser spotted dogfish (non-quota species and not subjected to the landing obligation) because they were observed to have a high survival rate, but no other fish were released. He did state, however, that plaice also often displayed good indications of survival, with fish still demonstrating clear signs of life long after capture. On the question of whether skippers are able to avoid catching the most restrictive quota species, the skipper of Virgo stated that there was scope to reduce catches of the main choke species of plaice but this was limited. One of the main difficulties envisaged, was in avoiding the capture of haddock, which is caught in relatively small quantities but was thought to be difficult to avoid spatially or to select out of the trawl without losing economically important squid.

Both haddock and squid move upwards within the trawl, so in areas or periods in which squid are not being caught there is opportunity to select out haddock and whiting using escape panels in the top of the trawl. But when squid are being caught it was thought too many would escape the trawl with these designs. Therefore, the highest risk of exhausting the catch quota for haddock would be during the squid season from July to December.

The skipper of Guiding Light was confident that he could avoid catching much of the small unwanted fish, which made up most of the discards in his catch. This could be achieved by increasing the mesh size of the codend to 100-110mm. The issue of losing squid was considered minimal for this vessel as when targeting squid there are few fish caught, and he had access to quota that could cover incidental catches. The skipper also suggested other modifications including an increase in the size of the hoppers on the footrope to avoid catching unwanted plaice and other flatfish; and using square-mesh panels to allow whiting to escape from the net. The skipper believed there was a psychological barrier for vessel operators in using more selective trawls, with skippers concerned that marketable catches will be lost. He believed that the fish escaping from trawl with these types of modifications were small and low value fish which it is better to avoid landing and will be even more so when the landing obligation comes into effect.

The skipper of Govenek of Ladram stated that selectivity of the gill nets for commercial species is high, and unlike trawlers, the netters catch almost no undersized fish. Moreover, the quota used by the trawlers in landing small haddock means that the economic potential for the quota is not realised. The skipper has increased the mesh size of the gill nets from 120mm to 125mm to avoid the capture of small and low value hake. However, this led to an increase in catches of cod. The skipper considers the optimal gill net mesh size for cod to be ~145mm but this would be too large to catch hake. The skipper also increased the hanging ratio to '5 in 3', with the intention of holding the meshes more firmly open and to avoid entangling the fish and therefore improve the selectivity of the gear. Skipper's knowledge of the fine scale spatial distributions of fish and tidal effects on fish behaviour is also used to avoid unwanted fish. There are areas in which only whitefish can be caught and the catch can be almost exclusively hake. However, it is not viable to focus only on one species, owing to the need to lease additional quota combined with price changes.

The skippers of Alfie Elliot, Girl Kayla, Kaya, and Oliver Henry stated that the gill nets they used are selective and different designs of net are used to target different species. According to these skippers, the species with the greatest potential to survive were turbot, brill and plaice.

The skipper and fleet manager of Admiral Grenville considered that they had near optimised the selectivity of the beam trawl gear, and there was an interest in generating discard survival estimates, in particular for small monkfish and plaice. They noted that it is extremely difficult to modify the beam trawl design further so that unwanted plaice are released while Dover sole retained.

3.6.5 Views on control and enforcement

The monitoring of catches under an obligation to land all quota species as required by the reformed CFP was discussed with all participating skippers. It was felt that the policy would be extremely difficult to enforce. Vessel operators and market managers participating in the trial recognised that there was little incentive for the unwanted material to come ashore. Not only will those catches be deducted from the catch quota and so reduce the quota available for the rest of the year, but the vessels will receive either little economic return for the material or even make a loss by paying to have the material handled and disposed of. As well as the vessel operators, the market staff at the ports do not want to handle low value fish, and would not encourage low value and poor quality fish coming to the market.

It was recognised that the landing of fish that might otherwise survive if returned to the sea will also discourage compliance with the landing obligation. To ensure catches remain onboard, it was stated, that there must be effective monitoring at-sea, otherwise the new policy will make no difference to the levels of discards. Three skippers stated that having cameras onboard was the only approach that would enable compliance with the discard ban. One skipper stated that as long as vessels arrived at the port with some undersized or unwanted quota species, no one would know whether that comprised all of the unwanted catches or not.

Some skippers were supportive of cameras in principle, but with reservations. For example, it was considered unlikely that all vessels would have cameras onboard, possibly only the larger vessels with the highest catching capability. If cameras were introduced for larger vessels, for example, over 10m vessels only, that could be sufficient motivation for fishermen of over 10m vessels to replace them with under 10m vessels. Also, there was a general low confidence in the ability of other EU Member States to adequately enforce the regulations. The result would be UK vessel operators being disadvantaged relative to those from other countries. Without effective monitoring, it was argued that compliance with the discard ban will be low and it may end up 'existing on paper' only. There was identified the risk of information on catches becoming less accurate and reducing the quality of the stock assessments and the scientific advice used to set quota levels.

On a technical point, the skipper of the Govenek of Ladram identified an important observation with regard to the electronic catch reporting tool that is required by all vessels over 15m (over 12m by 2014). An error in the e-log submission caused difficulty for this vessel; common skate was input as discarded, however the e-log recorded it as retained. This resulted in the skipper being met on the quay and questioned by French control authorities when the vessel landed in Roscoff.

Brixham harbour, Devon



© Cefas, Tom Catchpole

4. CONCLUSIONS

This discard ban simulation trial was conducted to inform fisheries managers, policy makers and the fishing industry on the various practical issues and challenges of implementing a discard ban in UK waters. The trial involved different sizes of vessels, gear types and fishing grounds and explored how fishing practices, catch handling, storage and transport could change as a result of the obligation to land all catches. In this trial we simulated a discard ban on all commercial species, which differs from the final agreed landing obligation, whereby only quota species will be affected. Therefore, more species and more otherwise discarded material were landed in this trial than will be required under the reformed CFP. The results and findings account for this discrepancy and are described in the context of the landing obligation as agreed in the Basic Regulation.

The trial successfully simulated a discard ban for eight vessels working for up to five months from three main ports. The main conclusions are presented under the following headings:

- Assessment of the fish caught – reasons for discarding
- Practical considerations of the discard ban (e.g. sorting, storage, transport, ports, unsold fish)
- Economic impacts of a discard ban
- Markets for fish currently discarded fish
- Impact on fishing mortality under the discard ban compared with current practice
- Enforcement of a discard ban

4.1 Assessment of the fish caught – reasons for discarding

All landings were recorded accurately and tracked to their final destination. Approximately 20 tonnes of fish were brought ashore that would have otherwise been discarded, 7 tonnes of unwanted catches were discarded back to the sea, either because the skippers were confident the fish would survive or because the fish were prohibited or subject to a zero TAC and could not be brought ashore under the conditions of the trial.

All of this fish were documented and there was a high level of confidence in the quantities and in the reported destination of those catches at first sale. Discard estimates generated by skippers were validated by scientific observers. Overall, 128 fishing trips were conducted during the trial of which 40 had a scientific observer onboard, equating to a coverage of 31% for the trial. Although there was trend for the skippers' estimates of unwanted catches to be lower than the observer's, overall, there was a close correlation between the estimates (R-squared 0.85). This was reaffirmed using independent data from the fishmeal plant which recorded weights of all material received. Having three different sources of data provided a high level of confidence in the accuracy of the data.

The participating skippers agreed with the catch patterns derived from the validated self-reported data and in the reasons for discarding during the trial. For gillnet vessels, a large proportion of the unwanted catches were damaged, either by seals, lice or starfish. For the gillnetters and otter trawlers, quota restrictions were a major cause of discards and also for the otter trawlers, weak markets for small but legally sized fish was a driver of discarding. For the beam trawlers and under-10m gill netters, the catching of undersized fish was the main reason for otherwise discarding catches during the period of the trial. Catching species with a zero TAC was a key driver for discarding in the large gill netter and the beam trawler.

Species which would have otherwise been discarded due to quota restrictions provided an indication of which might be the main choke species for the participating vessels. Fifteen species with associated quotas, and also skates and rays collectively, were discarded by the participating vessels. Vessel operators mentioned that the quotas for cod, plaice, haddock and Dover sole were the most likely to be exhausted first and so choke the fishery. These species were not often those being targeted by the vessel operator, but were incidental catches; and catches of these species would need only to be small to act as a choke for the vessel. If a vessel has limited access to quota for particular species, catching even small quantities may be enough to stop the vessel from fishing. The extreme example of this is for zero TAC species, which unless some quota is provided, then the catching of a single fish will be sufficient to close a fishery. Undulate ray and spurdog were the species for which this issue appears to be most important for the participating vessels.

The vessel operators all agreed that because catch and fishing patterns change during the course of the year, so to do discard patterns. The catches generated during the trial were considered representative of the period but were expected to be different from those at other times of the year and under different levels of quota restriction.

4.2 Practical considerations of a discard ban (e.g. sorting, storage, transport, ports, unsold fish)

The main considerations highlighted from the trial relating to practical issues are those relating to:

- Sorting the catch
- Handling the material on the vessel
- Storing the material on the vessel
- Landing the additional material
- Storing the material at the point of landing
- Transporting the material

Sorting the catch: Estimated weights of landed fish at the species level will be required to enable catches to be deducted from quota allocations. This will require species to be sorted to the species level. An observation of the trial was that separating species to record weights could add hours onto the time spent on deck by crew or potentially the need for more crew. This may have health and safety implications, with additional sorting of the catch required by the crew, or increased exposure to adverse weather conditions.

Handling the material on the vessel: The smaller vessels on the trial were particularly restricted for space on the deck. For example, the under 10 m vessels in the trial could carry only 6-7 fish boxes. The need for additional fish baskets or boxes on the deck was considered to increase the risk of slips and trips on deck by



Unwanted catch to be sorted, Guiding Light III

© Cefas, Tom Catchpole



Catch to be sorted, Virgo

© Cefas

crew for some vessels. Consideration will be needed to ensure that the layout of the vessel is modified where possible when retaining more fish, so as not to increase the risk of injury whilst working on fishing vessels and that stability of the vessel is not adversely effected. It is recommended that work be done to ensure that the safety of fishers is not compromised by the landing obligation. In particular, the effect on vessel stability, additional trip hazards on deck and sorting injuries for crew, should be assessed and guidance provided to vessel operators.

Storing the material on the vessel: Vessels in the trial, like many others, are set-up to store catches in fish baskets or fish boxes. It is likely that these will be used to contain the previously discarded catches. On one of the trial vessels, additional boxes had to be hired; the roll out of the landing obligation could necessitate many additional boxes and baskets having to be purchased by vessel operators. Similarly, hold capacity maybe a limiting factor for some vessels, whereby vessel operators will have to make additional landings to offload the catches before they can continue fishing, although this was not a problem for the participating vessel during the period of the trial.

Landing the additional material: The trial highlighted that there is a risk that inadequate preparations will have been made to receive the previously discarded material on shore. At some ports the need to land additional boxes of fish may cause congestion, with longer periods spent queuing by vessels to land their catches. Ensuring that there are sufficient physical points of landing at the fish quay will therefore be important. The logistical difficulty and cost of handling the material is likely to be higher at smaller ports, for example Polperro, where only a forklift truck has access to the fish quay, and the material must be loaded onto a lorry some distance away before being transported to a market auction. At the market auctions, the material needs to be moved to a storage facility. The need for additional staff and forklift trucks and for additional refrigeration units and areas for storage bins was highlighted; it may be necessary to store the material not destined for human consumption separately from that for human consumption and there may simply not be sufficient physical space at some markets. It was estimated that there could be up to twenty 600kg storage bins required on site in the largest markets at the busiest periods. There was no desire from the markets to handle, store, monitor or take responsibility for the non-human consumption material, because of its low value, it did not fit the current business models of the markets. Some security issues were also raised, namely that the undersized fish landed could enter human food chain.

Transporting the material: One key observation from the trial was the considerable time and effort required by Cefas and UFI staff to organise and monitor the collection and delivery of the material. It is recommended that a designated role is created, at least at the start of the implementation of the discard ban implementation, to ensure storage bins are available and picked up from the various ports. During the trial, there were a sufficient number of companies with sufficient capacity to transport the otherwise discarded material. All species with associated quota had to be transported to the fishmeal factory for the trial, but this would not be the case the under the landing obligation. This material will be available for other local outlets, for example pot bait, and so may not require transportation. It was a requirement of the fishmeal company that 'Raw material specification and declarations' were completed by all participating skippers wanting to land fish for fishmeal. This will be requirement for all vessel operators who land fish for fishmeal. Moreover, some mechanisms to track the material for fishmeal landed by each fishing company and transported to the

fishmeal factory is required so that correct payments can be made to the vessel operators. The alternative is for the markets to manage the process and payments.

The additional sorting, the challenges in handling and storing material both on the vessel and at the point of landing, will discourage vessel operators from catching and landing unwanted material. From just a practical point of view, there will be an incentive to avoid catching and landing unwanted fish.

4.3 Economic impacts of a discard ban

There are several potential economic impacts of the discard ban identified in this study; details on some of these were generated in the trial. These impacts can be broadly categorised as potential losses and gains:

Potential losses

- Losses associated with costs and charges of sorting, landing and transporting otherwise discarded fish
- Losses associated with foregone catches after cessation of fishing due to exhausting quotas (choke species)
- Losses associated with counting undersized fish against quota that could otherwise be used to land fish onto the human consumption market
- Losses associated with reduced catches of non-limited (underutilised) quota and non-quota species when improving selectivity to avoid quota limited species

Potential gains

- Gains for non-human consumption outlets that can utilise and profit from previously discarded catches
- Gains from avoiding quota limited and undersized fish and maximising revenues from uplifted quota allocation
- Gains for transport companies and storage companies (including markets) that will handle the previously discarded catches
- Gains associated with selling otherwise discarded fish onto the human or non-human consumption markets

The task of having to sort previously discarded catches and retain them onboard could have associated costs. Participating skippers noted that the additional time sorting the catch may slow the fishing operation on some vessels and reduce the amount of fishing time. It may also be necessary to modify the layout and sorting processes onboard some vessels to enable all catches to be sorted and stored.

As a condition of the trial, all quota species which were either under the legal size or for which there was insufficient quota to land had to be processed into fishmeal. Although some other outlets were used for some non-quota species, most of the otherwise discard catches were sent for fishmeal. The estimated cost to vessel operators in landing material to the fishmeal market during the trial of £160 per tonnes is considered to be a maximum owing to several factors:

1. The participating ports were some of the furthest away from a fishmeal plant, therefore transport costs would be less from other ports
2. The quantities being transported did not allow for the most efficient use of lorries with storage bins being moved that were less than full; when operating on a fully commercial basis, it is likely that storage bins would only be transported when full
3. The scale of the trial was too small to allow for the most efficient use of catch handling services; because it was a trial, one-off costs were paid to markets to deal with the material, which were higher than would be expected following implementation of the discard ban
4. The previously discarded catches have a financial value and it is likely that improved efficiency in handling and transport, and increased competition for the material would evolve and so improve returns to the vessel operators

Some of the participating vessels were already making good use of the market for pot bait for non-quota species prior to the trial, these fish were not recorded as otherwise discarded fish. Currently, it is not legal for fish under the MLS to be carried on board potters for use as pot bait. However, this market will be available for these fish under the landing obligation. The pot bait market is more lucrative than the fishmeal market, with material worth around £200 per tonne and it usually requires little or no transport. However, the market is available only when there is fishing activity by the potting vessels and could become saturated with large amounts of material coming ashore.

Additional staff time and equipment is expected to be required at the markets to handle the previously discarded fish, as well as investment in additional storage facilities. At Brixham market it was estimated that up to three additional staff and an additional forklift truck would be required to deal with the extra material. Fish markets focus on the sale of human-consumption fish and the receipt of large volumes of low value material does not fit well with their business models. As is the case currently, any costs of handling material for non-human consumption would likely be passed to vessel operators. There was a general reluctance from all managers of the participating markets in having to handle this material, however, there is a value associated with it and potential opportunities for new business in storing, transporting and processing this material.

The most substantial potential economic loss is associated with the cessation of fishing due to the exhaustion of quota. Although the most likely species that would choke the fisheries were considered for the participating vessels engaged in this trial, it was outside the scope of the project to assess the risk and potential impact of choke species. It was apparent that one of the highest risks is with the zero TAC species, where without some quota, the incidental capture of one fish could in principle stop a vessel from fishing. In addition to this, the need for sufficient flexibilities in the allocation of quota was highlighted, particularly for non-sector vessels, which do not currently have the same flexibilities as those afforded in Producer Organisations. It is recommended that work be done with Producers Organisations and fisheries managers to identify mechanisms that will ensure the highest levels of flexibility in quota usage both internationally and domestically.

The potential gain associated with the landing obligation is associated with the uplift in quota in the transition from landings quotas to catch quotas. By altering catch compositions through changes in selectivity and behaviour it is possible to avoid small, low value size classes and the most restrictive species to increase profits from available quota. Therefore, improving selectivity, where possible, is the most effective way to offset any impacts of the landing obligation and maximise profits for vessel operators. Losses may also be offset where high survival rates can be scientifically demonstrated. Exemption from the landing obligation is possible under the high survival provision. The proportion of fish proven to survive after having been released would not be deducted from quota. There are a number of scientific studies underway to investigate survival rates around Europe including several studies on English and Welsh fisheries being conducted by Cefas.

Another cost which has could have substantial impacts is the deterioration of data quality on fish catches. Some participating vessel operators identified that data deficiencies were the highest risk in the transition to catch quotas and the landing obligation, whereby underestimating discard levels would provide an insufficient uplift in quota to enable the vessel to operate for the full year. Moreover, if the quality of the data on catches after the implementation of the landing obligation deteriorates, then the quality of the stock assessments will be effected and the confidence in the quota advice will be reduced. If catches are underreported, it will effectively appear as though less fish are being caught per unit of fishing effort and stock sizes will appear less than the reality. The risk can be mitigated through accurate recording of catches. It is recommended that sufficient monitoring (fully documenting catches) is put in place to ensure confidence in catch estimates and that independent data from scientific observations and data from buyers of human consumption and non-human consumption material is used to validate reported catches.

4.4 Markets for currently discarded fish

As a condition of the trial, all catches of quota species not going for human consumption had to be utilised as fishmeal. Fishmeal is one of a number of potential outlets for this material; fishmeal sold in this trial for £120 per tonne and pot bait for £200 per tonne, the other outlet used by participants was anaerobic digestion, but this was at a cost to vessel operators of £75 per tonne. Other potential outlets for the material were also mentioned, including the pet food and mink feed industries.

The study indicates that material currently being discarded has many uses, and it has a value, there are a number of outlets for the material and there will be competition for the material. This should reduce the costs of disposing of the material for vessel operators; however, if there are profits from the material they will be slight and will be only a fraction of the profits from fish sold on the human consumption market. Whether it generates profit or loss will depend on the scale of handling and transport costs and the seasonal variability in demand for the material. There is no indication that there will be an incentive for vessel operators to target small fish for non-human consumption markets based on the findings from this study.

Small but legally sized fish of species with associated quota is currently often discarded (high graded). This is because either the species has a restricted quota and the quota is reserved to land the most valuable grades, or that these size classes of fish have no market value. Under the landing obligation this fish will come ashore and vessel operators will likely try to sell this fish on the more lucrative human consumption market first to attempt to achieve the highest profits. Therefore, it is likely that more legally sized small grades will enter the market and market managers and buyers should be prepared for this possibility. It is recommendation that preparations be made for the likelihood that more, small, but legally sized fish is made available on the human consumption market.

4.5 Impact on fishing mortality of a discard ban compared with current practice

Fish which would have survived if caught and returned to the sea but instead have to be landed will constitute mortalities that may otherwise not have occurred. Exemptions will be sought where scientific evidence is assessed to demonstrate high survival for a particular combination of species and fishery. However, where no exemption is awarded, there will undoubtedly be mortality of some retained fish that would have otherwise survived had they been returned to the sea. If the incentive framework of the landing obligation is successfully developed, then vessel operators will want to avoid catching unwanted small, low

value and restricted species and fishing mortality in general will be better controlled to the benefit of the whole fishing industry.

There are risks to the management of fishing mortality and of fisheries associated with the implementation phase of the landing obligation. Current estimates of discarding are based on scientific observations made on a relatively low number of fishing trips. For some vessels which may be poorly represented by observer programmes, the level of actual discards may be substantially different to the estimated levels. If the actual levels of discards are higher than the estimated level, then vessel operators will need to avoid more of the previously discarded fish to prevent an economic impact. In this case, assessed fishing mortalities will have been underestimated. If the actual levels of discards are lower than estimated, vessel operators can simply convert the uplift to saleable fish.

With adequate monitoring, there is expected to be more accurate information generated through full catch documentation. This is considered to be one of the main benefits of the reformed CFP which will enable better assessments and management of the stocks. However, because current estimates of discards are based on relatively few data, under the landing obligation the reported catch rates of previously discarded material could be quite different. Moreover, the expectation is for changes in selectivity by vessel operators; therefore, any changes in reported levels of unwanted catches compared with the current estimates could be due to either:

- i. poor estimation of these catches prior to implementation
- ii. low compliance with the landing obligation
- iii. changes to the selectivity, or
- iv. changes to the stock structure and composition of catches.

It will be essential to know which, if any, of these factors are operating. It is recommended that during the implementation phase, sufficient monitoring is in place to provide confidence in catch levels. Information should be analysed in real-time from vessel operator reporting systems, registered buyers and sellers and from independent scientific observations. These data should be cross-checked and analysed in the context of the forecast catch levels and quota availability. It is also recommended that an evaluation be undertaken to assess the extent to which the current observer programme can serve to provide a reference fleet to validate self-reported catches and registered sales data. It is further recommended that consideration be given to how discrepancies between skipper reported, independently observed and forecast catches be dealt with.

4.6 Enforcement of a discard ban

Without adequate enforcement, the incentive framework to successfully deliver the objectives of the landing obligation will be absent. Unless catches are accurately monitored, there will be reduced incentive to avoid or record unwanted catches, furthermore, the data being used for the assessments will be poorer with knock-effects to the quality of the stock assessment and quota advice. The main incentive for the vessel operators to accurately record catches under the landing obligation is to maintain data quality, control fishing mortality and ensure sustainable fish stocks into the future.

There is to be a fundamental shift in how fisheries will be monitored, from a situation whereby fishing vessels are restricted in what can be retained onboard to one where they will be restricted in what can be discarded. This change will require new methods that will monitor total catches taken by fishing vessels, including remote electronic monitoring, observer programmes and self-sampling schemes. Data from the full documentation of fisheries should also be utilized, where possible, to satisfy the evidence needs of the Data Collection Framework (DC-MAP) and Marine Strategy Framework Directive (MSFD). Given the practical challenges of enforcing a discard ban, there will need to be an emphasis on getting buy-in and support from vessel operators to record catches. Understanding the business benefits of accurately recording catches should be an area of focus. The enforcement process will introduce more direct incentives in the way of penalties and sanctions for discarding.

The monitoring system currently in used by the over 10 metre vessels is, at least in part, capable of generating accurate catch data. The prior notification protocols and e-log books were used during this trial to monitor total catches. There were some technical problems when using the e-logs to record discards and changes may be needed to record material that is landed for non-human consumption. It is recommended that robust testing of the e-log system is conducted to ensure that vessel operators have the necessary tools to record their full catch including catches destined for human consumption, for non-human consumption and those released back to the sea. Self-reported data can be cross-checked using independent scientific observations and registered sales data. It is recommended that the feasibility of collecting species specific landings data from non-human consumption markets be explored, and to assess the possibility for those industries to be included within the registered buyers and sellers system.

For the under 10 metre sector, it was clear from the start of the trial that recording full catches was a challenge. Currently, no prior-notification of landing or the use of log sheets is required for these vessels. It was not possible to agree a method by which vessel operators could self-report their catches. It was considered by skippers logistically difficult to produced accurate paperwork whilst at-sea and, with vessels working close inshore, not practical to give prior notification of landing. The control agents needed to be able to effectively monitor the catches coming ashore and so the only way to do this was for scientific observers to be present throughout the trial to record all of the catch information but this is not a practical arrangement with the implementation of the landing obligation. It is recommended that work be undertaken to determine how new self-reporting tools, independent at-sea observations and registered sales data and be integrated to deliver full documentation of catches in the non-sector under 10 metre fleet.

The difficulty in enforcing the landing obligation and therefore in fully documenting catches was highlighted by the skippers participating in this trial. Although the trial could not operate within the incentive framework that is expected with the discard ban, all catches were recorded accurately for enforcement and scientific purposes. This success was due to considerable organisational effort and support for the trial from Defra, Marine Management Organisation, Cefas, vessel operators and crew, market managers and staff, transport companies and the UFI fishmeal company. To achieve this when the landing obligation is implemented will require the same level of communication, co-operation and partnership working.

A review of the success of the landing obligation will be part of the mid-point review of the reformed CFP in 2019. There should be mechanisms in place to assess the effectiveness of the implementation of the Landing Obligation, including the collection and analysis of information from enforcement data, self-reported catch data, independently observed data, registered sales data and the assessed status of stocks.

5. RECOMMENDATIONS

The outputs and observations from Discard Ban Trial have generated ten recommendations which would be expected to facilitate the implementation of the Landing Obligation.

1. Work should be conducted to ensure that, the safety of fishers is not compromised by the landing obligation. In particular, the effect on vessel stability, additional trip hazards on deck and sorting injuries for crew, should be assessed and guidance to vessel operators provided.
2. Work should be done with Producers Organisations and fisheries managers to identify mechanisms that will ensure the highest levels of flexibility in quota usage, both internationally and domestically.
3. Information on catches should be analysed in real-time from vessel operator reporting systems, registered buyers and sellers and from independent scientific observations during the implementation phase of the landing obligation. These data should be cross-checked and analysed in the context of the forecast catch rates and quota availability.
4. Consideration should be given to how discrepancies between skipper reported, independently observed and forecast catch rates be dealt with, if they arise, during the implementation of the landings obligation.
5. A designated role should be arranged, at least at the start of the implementation of the discard ban, to ensure that storage bins for material destined for non-human consumption uses are available at ports and to facilitate the coordination of the transport of the material.
6. Preparations should be made for the likelihood of more small, but legally sized fish will be put on to the human consumption market.
7. The feasibility of collecting species-specific sales data from non-human consumption markets should be explored, and for industries receiving this material to be included within the registered buyers and sellers system.
8. Robust testing of the e-log system should be conducted to ensure that vessel operators have the necessary tools to record their full catch, including catches destined for human consumption, for non-human consumption and those released back to the sea.
9. Work should be undertaken to determine how new self-reporting tools, independent at-sea observations and registered sales data can be integrated to deliver full documentation of catches in the non-sector under-ten metre fleet.
10. An evaluation should be undertaken to determine the extent to which the current observer programme can serve to provide a reference fleet to validate self-reported catches and registered sales data.

6. ACKNOWLEDGEMENTS

This report is dedicated to the memory of David Peach. Dave was instrumental in the success of this project. Never daunted by the challenges, he applied his plentiful knowledge, many skills and his wide network of friends to overcome all the difficulties we were faced with. He died in April 2014 and will be deeply missed by many.



I would also like to thank the vessel operators and crew, market managers, staff from Cefas, MMO, Defra and the transport companies for their co-operation and positive contributions which enabled this project to succeed.

Appendix 1 Dispensations required to progress the project

Dispensations were required to enable the retention of all fish that were undersized (below MLS) and for which the vessel had insufficient quota to land. Dispensations from catch composition regulations were also required. These were agreed and issued by the control agent, the MMO. Vessels were not obligated to put to the human consumption market all fish that were over MLS. All fish were landed, so any fish over the MLS but not sold on the human consumption market could not be categorised as high-graded. However, these fish were not deducted from the vessels quota. This was a critical point to enable vessel operators to participate in the trial.

The regulatory exemptions supplied were as follows;

A. COUNCIL REGULATION (EC) No 850/98 in respect of:

- Article 4, to allow the retention and landing of fish which would otherwise be in breach of catch composition rules for towed gears.
- Article 11, to allow the retention and landing of fish which would otherwise be in breach of catch composition rules for fixed gears.
- Article 19, to exempt from the requirement to return undersized fish immediately.
- Article 17, to allow the retention and landing of fish below prescribed minimum landing sizes.

B. COMMISSION REGULATION (EC) No 43/2012 in respect of Article 8, to allow for the retention and landing of fish for which the vessel has no quota allocation except in cases where a species is subject to zero TAC in which case catches must be returned to the sea.

C. Sea Fish Conservation Act 1967 in respect of Section 4 (5) (c) to allow the vessel where necessary to land fish in excess of catch limits prescribed in the fishing licence.

The dispensations highlighted the areas of current technical measures legislation that are in contradiction with the proposed landing obligation.

Appendix 2 Vessel tendering process

Due to funding constraints and other logistics, eight vessels operating in ICES areas VIId and VIle were used in the trial. Vessel selection was based on ensuring that a variety of fisheries, vessels sizes, fishing ports and gear types were included. The vessels operating in the two ICES areas were invited to apply to participate in the trial through an open tender process. To generate interest in the trial, and explain the aims of the project and its importance to the fishing industry, a press article was placed in the trade newspaper, the Fishing News (3rd August 2012), alongside the invitation to tender. The tender document was also posted online and hard copies were distributed to local port authorities in the main fishing ports in the south of England.

Interested skippers were required to provide details of their target species, fishing gear and fishing grounds. Owing to the potential for inconvenience to the skippers and economic cost from participating in the trial, a financial incentive was offered. It was agreed that vessel owners would be paid a percentage of their first sales revenue, with a cap of up to 10%, which would be validated through the provision of sales notes for the period of the trial. The skippers therefore provided a percentage value, not exceeding 10%, as part of their application. Following discussions with some skippers of the smaller vessels, it was agreed that because the cost of landing currently discarded fish would be greater than 10% of their revenue, a comparable fixed fee would be offered to these vessels, rather than a percentage of first sales revenue. The project costs were estimated based on information on landings for the previous year and their percentage sales revenue bid as given in the application. The selection process provided the maximum number of vessels on the trial for the longest possible period (Table 1).

Appendix 3 Questions for participating skippers/markets

Objectives of the project were described:

Understand the logistical implications of the discard ban: how can the fish be handled, what is the impact on the vessels and crew, what are the main reasons for current discards, how will the fish be handled stored and transported on shore, what are the potential economic costs?

Presentation of the data generated by the skippers to the skippers:

Main species discarded

Main reasons for discarding

Reasons for discarding and cleaning the data

Awareness of quota species, MLSs other restrictions on landing, maximum landing sizes, zero TACs.

Discussion about market implications:

How representative of normal fishing practice was the period?

Did you do anything different?

Did you buy in any additional data?

Did you sell any material on the human consumption market that you would not otherwise have done?

Did you sell any material to pot bait that you would not have otherwise have done?

Did you fish in the same areas as usual for the time of year?

Did you use the same fishing gear as usual?

Did you try to avoid any unwanted catches?

Discuss operational implications:

How was the practical activity of fishing altered?

How did you manage the additional material onboard?

What was the main impact of retaining the fish onboard?

How were the crew impacted by retaining the fish?

How and where were the additional fish stored? - Why did you use ice/boxes?

What happened when the fish were landed?

Present some background on CFP - what is in the reform:

Move to a land all obligation 2015 pelagics and demersal quota species 2016-19. Defra communications plan to start imminently. Banking and borrowing of quota between years, offsetting quota for a species against the target species up to 10%, exemptions where high survival can be shown, a *de minimis* exemption of up to 5% (where it is demonstrated impractical/unsafe to retain fish, or not possible to select out unwanted fish)

Opinion about the new policy including economics implications:

Opinion on what the specific vessel will have to do in the context of new policy?

Was it manageable?

Was it safe?

Did it cost more to land the material?

What are the main risks to your business?