What's going to happen with the CFP Reform discard policy?

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Abstract

The European Common Fisheries Policy Reform includes new discard regulation that is likely to have the greatest impact on fisheries and fleets of any recent regulation. However, there is a distinct lack of data or empirical knowledge available to inform the effects on fleets. This regulation has the potential to result in a step change in fishing behaviour. There is much written on the economics of discards, for example the knowledge of what is rational behaviour regarding discarding Vs incentives driven by policy not to discard. In this paper, we consider what fisheries economics theory tells us as well as exploring gaps in our knowledge. We use an empirical example of the North Sea demersal fisheries to consider implications further.

Keywords: fisheries economics, bioeconomics, discards

INTRODUCTION

The EU's new regulation on discarding (see CEC 2009; COM 2009) has introduced new challenges to Member States. Currently, discarding happens for several reasons: lack of quota; fish that are below the legal minimum landing size; catch composition rules, limiting the percentage of a species within the catch; or species for which there is no or low market value.

Discarding or bycatch or unwanted catch is commonplace in multi-species fisheries. Currently in the EU, fish that is caught for which a vessel does not have a permit must be returned to the sea. This is a legal obligation as it is illegal for fishermen to land species for which they don't have a permit. As a result, the Common Fisheries Policy recognises that discarded fish do not count towards a fisherman's quota. Much has been written about the incentives of discarding (e.g. Hatcher, 2014; Arnason, 1994; Vestergaard, 1996), and the theoretical point that fishermen are incentivised to discard whenever benefits outweigh the penalty or as is typically considered whenever "the (opportunity) cost of retaining and landing fish exceeds its market value" (Pascoe 1997). This is not simple as fishing opportunity in the EU is for the most part allocated over a year and not by trip or at a given instant. Therefore, at what point are the rules enforced becomes a key question as fishing conditions, stock availability (i.e. catch composition) and behaviours vary across the year. Overall, little appears to be known about how to change behaviours that impact negatively from a biological and economic point of view. As a result, the CFP Reform has found itself implementing a discard ban to "force" compliance.

From 2015 to 2019 in a phased approach, it will become mandatory for fishermen in the EU to land all fish caught, at least with regard to quota species. Pelagic fisheries will start with a discard ban in 2015, demersal fisheries in 2016 and across all TAC species by 2019. This will affect the fishing operation significantly and is considered by many to be the greatest change in fisheries management in Europe since the initialisation of the CFP in 1983 and possibly before that.

Other than a simplified ban on discarding, there are three possible means of bycatch reduction:

- modifying fishing methods including gear, timing or location of fishing or other aspects of the methodology, such as the introduction of bycatch reduction devices
- changing fishing gear or fishing methods entirely, such the change from trawls to traps
- reducing fishing effort and therefore the amount of fishing gear in use overall

Any one of these methods alone does not necessarily guarantee the reduction of bycatch, but one or more must be a component of any conservation program to reduce the loss of resources due to bycatch. Hence, a ban on discarding will drive such changing behaviour with regard to technical measures, the consequences of which may not be desirable in the short term. Markets can also play a role (e.g. Arnason, 2014). Regulation through technical measures and effort control is important however to achieve the goal of a discard ban then it's likely that voluntary take up of some bycatch reducing measures will be required. It is worth noting that better selectivity is relevant to all.

The impact of discarding varies by species: some have low survivability when discarded (e.g. cod, haddock etc) whereas others may have higher survival rates (e.g. sharks or crustaceans, such as Nephrops). From an economic point of view, discards add no value to a vessel's income but because of the difficulties in multi-species selectivity discards enable quota allocated to a vessel to be maximised. Fishermen behaviour with regard to discarding is clear. However, creating a framework that guides the modification of behaviour is less clear. Current levels of discarding as reported for demersal trawlers in the North Sea by the Discard Atlas of North Sea fisheries are presented in Fig. 1.

(Source: the Scheveningen Group, 2014)

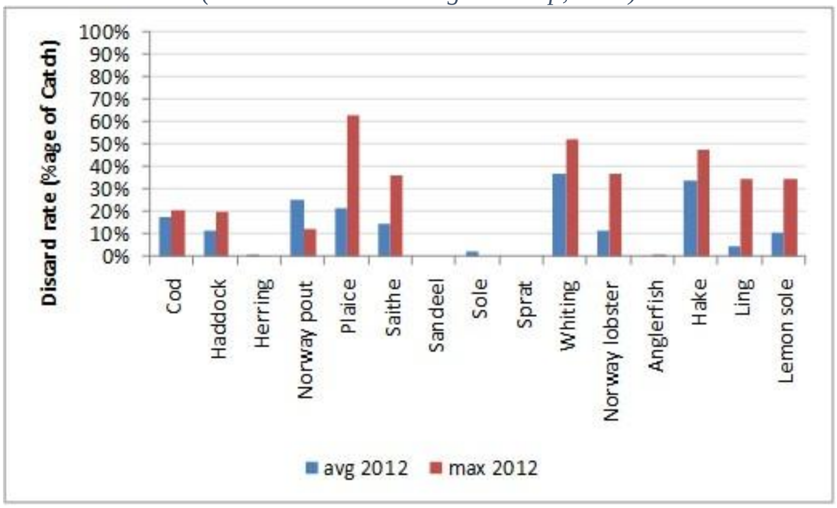

Fig. 1: Discard rates for modelled species in the North Sea with demersal trawl gear.
[Total landings Vs total catch (avg 2012) and landings Vs catch by country with max discard rate (max 2012)

The discarding ban promotes the premise that as soon as a vessel has caught its quota (or landing limit) of a particular species it must stop fishing. This means that a vessel must stop fishing as soon as one of its permitted species goes beyond its quota. Therefore, fishermen will not be able to catch fish where they have remaining quota for the likelihood of catching a species already at their limit. One option open to fishermen in this case includes purchasing (or leasing) additional quota. However, the new CFP discard regulation does not distinguish between a vessel's targeted species (for which they often have quota) and the vessel's non-targeted species (for which they don't have quota). Therefore if a vessel has minimal or no quota for a species then that species, sometimes referred to a 'choke' species, if caught will prevent the vessel fishing. In addition, the change in landing composition that will result in landing all catch will change the market for quota dramatically as vessels from different fleets and using different technology will be chasing the same quota.

For species that are targeted by a vessel where it has a good allocation of quota, discards will be minimal (if not zero), however for species where this is not the case and due to catch composition they cannot be avoided then three options are available:
- landed and sold (where quota is found via leasing or transfer),
- landed and 'given up' on shore (e.g. fishmeal), or
- discarded at sea (e.g. through so-called 'de minimis' exemption).

In this paper we consider the economic theory of discarding and explore gaps in our knowledge and also introduce an empirical example of the North Sea demersal fisheries to consider implications of the discard ban further.

ECONOMIC THEORY OF DISCARDING

The economic theory of discarding is based on a few key papers: notably Anderson (1994), Arnason (1994) and Vestergaard (1996). These are all based on similar assumptions and have been developed in various ways over the years (e.g. Turner 1997; Abbott and Wilen, 2009; Singh and Weninger 2009; Holland 2010; and Hatcher, 2014) and put in place the theory for consistent economic analysis. The majority of such studies have concentrated on ITQs and the consequences of high-grading. Several studies have attempted to estimate the effects of discards (e.g. Alverson et al., 1994; and Pascoe 1997). In addition, there is the continuing effort of international organisations to collect data and knowledge regarding discards (e.g. ICES Working Group reports). However there does not appear to be consistent approach to measuring discards in multi-species fisheries around the world.

Here, we take Clark's basic bioeconomic model (Clark, 1980) of an open access view of fisheries as the starting point for considering discarding simply. Clark develops ideas of dynamics, optimality and regulation also which can also be considered.

Harvest (*h*) for a vessel (*i*) is calculated as the product of a constant catchability coefficient (*q*), standardised effort of the vessel (*E*) and the fish population biomass (*x*):

(1)

In this case harvest is equivalent to landings (*l*). The Clark model doesn't differentiate between landings and catch but in reality landings will almost always equal catch minus discards (or unwanted catch) as harvest contributes directly to fishing revenue. Therefore, we assume that discards (*d*) are greater than zero.

Therefore the following simple observations can be made:
- Effort (E) is applied to the fishing activity and results in a total catch,
- Catchability (q) can vary for different segments of the fish population, and
- Biomass (x) can be divided into targetable and non-targetable components.

In the simplest case for modelling discards explicitly, catchability can be defined differently for landings and discards:

(2)
(3)

Where . This approach could be expanded to split the biomass (x) into a stock of "landable" fish and a stock of "non-landable" fish (in a similar approach to Pascoe, 1997).

The profitability of a vessel can be calculated as in Clark's model:

(4)

Where price (p) is different for landed and discarded quantity. Note that Clark's model results if the price of discards equals zero. If we assume that the cost of handling discards is proportional to the amount of discards then we can define a "discard" cost function

(5)

Therefore, marginal revenue (MR) can be defined as,

(6)

Observations:

- If $p_d < c_d$ then the cost of discarding outweighs catching unwanted fish thus resulting in reduced effort, also resulting in a higher equilibrium stock level under open access
- If $p_d > c_d$ then the cost of discarding incentivises catching unwanted fish thus resulting in increased effort, also resulting in a lower equilibrium stock level under open access.

Catchability of unwanted fish can be controlled through the level of technology investment and effort applied. Therefore it can be approximated that it is a function of cost of effort,

(7)

It can be assumed that catchability of landings will follow the same trend as catchability of landings.

— (8)

If a wider mesh size is invested in or even if the speed of a vessel is decreased (assuming that mesh size is closer to its maximum than under lower speed) then less discarded fish are caught.

If cost per vessel goes up then effort goes down. Moreover, if cost of effort per vessel goes up then catchability of discards goes down.

Consider the optimal case

(9)

(10)

This results in,

(11)

If $p_d < c_d + \ _d$ then stock with a discard ban will be greater than stock without a discard ban.

Moreover,

- If stock with discard ban is less than stock at MSY then the optimal level of landings with discard ban will be greater than landings without discard ban
- If stock with discard ban is greater than stock at MSY then the optimal level of landings with discard ban will be less than the optimal level of landings without discard ban

EMPIRICAL MODELLING USING FISHRENT

Fishrent (Salz et al., 2010) is a multi-species multi-fleet bioeconomic model that has been developed from best practice knowledge gained from similar models used in Europe over the past decade (e.g. Frost et al., 2009; Hoff and Frost, 2008). A key element to Fishrent is that fleet and economic data has been structured on data collected as part of the Data Collection

Framework. This enables consistent analysis to be conducted ensuring that best available national data is used. However, where possible the data relating to specific fleets can be updated to provide more in depth analysis. The biological module is founded on ICES published data for the key stocks where parameters are estimated offline to populate the necessary biological functions in the model to track the status of the stocks. Fishrent uses a Cobb-Douglas production function to estimate catch year-on-year. The output of Fishrent is designed to provide a full economic assessment of the fleets considered over a period of 25 years. Also, biological variables are calculated for each year, including stock biomass, recruitment and fishing mortality. Note that all results are available by Fleet (i.e. Country, Main gear and Length of vessels), Species (i.e. Stocks) and Year. See Frost et al (2013) for a recent implementation.

This North Sea demersal fishery is one of the most important economic areas for fishing in the EU. This involves the fleets from several Member States all of whom have different interests in the fisheries, as indicated by quotas allocated (Table 1). There is and has been since the inception of the CFP, and for 50 years plus previously, considerable management of these fisheries and with the CFP Reform this management will change significantly in forthcoming years. For example, discard regulation banning discards for demersal fisheries will come into force in 2016. Given the multi-species nature of these fisheries, this could have a significant impact on the success of these fisheries and the viability of relevant fleets over time. Fishrent is well placed to investigate the likely impact on fleets and fisheries given these new policies.

Table 1: North Sea 2011 quota allocated (in tonnes) at beginning of year (ref. EC TACs & Quotas Poster, 2011)

	Belgium	Denmark	Germany	France	Netherlands	UK	Estimated model coverage
Anglerfish	341	752	367	70	258	7,846	52%
Cod	793	4,557	2,889	980	2,575	10,455	88%
Haddock	196	1,349	858	1,496	147	22,250	98%
Nephrops	1,227	1,227	18	36	631	20,315	71%
Saithe	32	3,788	9,565	22,508	96	7,333	78%
Whiting	286	1,236	321	1,857	714	8,933	77%

There is and has been since the inception of the CFP, and for 50 years plus previously, considerable management of these fisheries and with the CFP Reform this management will change significantly in forthcoming years. For example, landing obligations banning discards for demersal fisheries will come into force in 2016. Given the multi-species nature of these fisheries, this could have a significant impact on the success of these fisheries and the viability of relevant fleets over time. Management Plans for these fisheries are still in the early stages of development and Fishrent is well placed to investigate the likely impact on fleets and fisheries.

The Fishrent North Sea demersal case study aims to evaluate several new management scenarios with respect to the key fleets targeting demersal stocks in the North Sea. The three key and related management options that will be assessed through a variety of scenarios based on the landings obligation include: discarding, effort management, and capacity assessment.

The fleets operating in the European fisheries are generally described by primary gear used, vessel length groups and country of origin. Economic data is collated in the DCF at this level. Biological data is collated by stock where stocks are defined by similar area boundaries to ICES sub-areas. The Fishrent model is designed to be able to use data at such an aggregated level to ensure consistency with such publicly available data. The economic data for the fleet segments has been obtained from the STECF '2012_EWG 12-05_EU FLEET ECONOMIC AND TRANSVERSAL DATA_FS LEVEL' database. The economic parameters included in the model are based on average values over the period 2008-2010. Estimated prices are based on average prices over the period 2008-2010 using the STECF '2012_EWG 12-05_EU FLEET LANDINGS DATA BY SPECIES_FLEET SEGMENT LEVEL' database.

Fifteen species are included in the model:
- demersal 'whitefish' species – cod, haddock, saithe, whiting, hake, ling and anglerfish;
- demersal 'flatfish' species – plaice, sole and lemon sole;
- pelagic and 'industrial' species – herring, sandeel, sprat and Norway pout; and
- shellfish – nephrops.

ICES stock assessments are available for ten of the stocks and modelled with assessed biomass, but for five of the species (lemon sole, anglerfish, ling, hake and nephrops) a non-assessed CPUE approach is taken. 2011 is used as the base year for the projections performed with Fishrent.

RESULTS

Three simulations are implemented to investigate a discard ban: first, a baseline based on current policy of allowing fishing up to the quota of all species (i.e. TAC_{MAX}), second a look at a 0% discard ban with 30% quota uplift, and third a look at a discard ban with 10% exemption and a 30% uplift. The latter two scenarios are based on the premise that fishing stops when any of the species that a fleet catches reaches the quota for that fleet (i.e. TAC_{MIN}). The point therefore of the uplift is not necessarily to enable 100% uptake at that level but to compensate for additional effort lost through choke species.

TAC_{MIN} = the most restrictive TAC is used to determine the level of effort that a fleet can exert.
TAC_{MAX} = the least restrictive TAC is used to determine the level of effort that a fleet can exert.

- Scenario 0: Baseline 2011 (TAC_{MAX})
- Scenario 1: Discard ban (TAC_{MIN}) – 0% discards, 30% TAC uplift, No quota trade, Species must contribute >2% share to fleet catch to impact effort
- Scenario 2: Discard ban with 10% exemption (TAC_{MIN}) – 10% discards, 30% TAC uplift, No quota trade, Species must contribute >2% share to fleet catch to impact effort

Note: Year 1 reflects the current management strategy (i.e. the baseline) for all scenarios.

The average biomass across species over 25 years is indicated to be greater for all species under the scenarios compared to the baseline (i.e. 100%) except for plaice (see Fig. 1). The four main whitefish species (cod, haddock, saithe and whiting) all indicate increases in stock biomass, suggesting a significant decrease in fishing effort by the fishing fleets modelled.

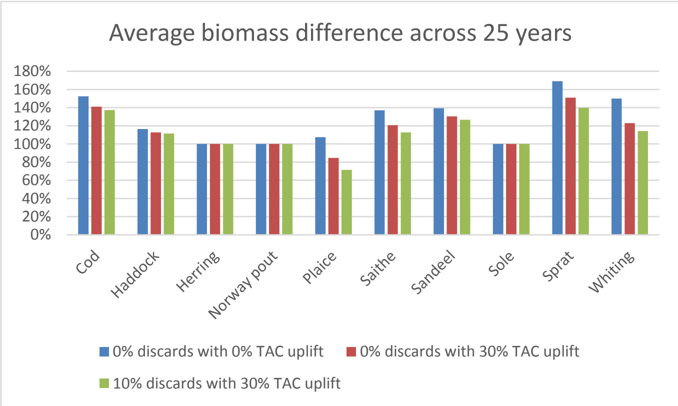

Fig. 2. Average biomass difference between scenarios and baseline across 25 years modelled.
[Note: herring, pout and sole are taken in small amounts and are assumed not to impact the modelled stock status.]

The average number of vessels and the average effort across fleets over 25 years in the scenarios is for the most part significantly lower than in the 100% baseline (see Fig. 3). Vessels vary between 40%-90% in the scenarios and sea days vary between 10%-60% versus the baseline. Such a reduction in effort results in the increases in biomass shown in Fig. 2. The reduction in vessel numbers is driven mostly by the profitability of the fleet being restricted in the early years of the simulation and the reduction in the number of sea days is driven mostly by the quota available to a given fleet for the most restrictive stock.

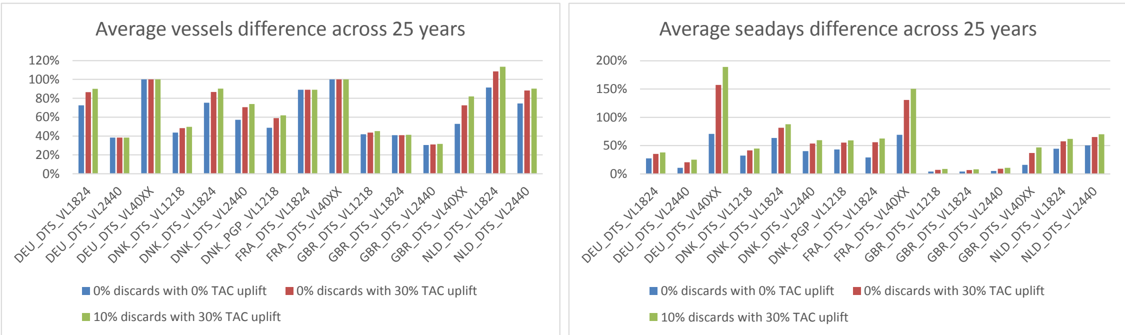

Fig. 3. Average vessels and days difference between scenarios and baseline across 25 years modelled.

Even though the number of vessels is decreasing strongly in the early years of the simulation, the improvements in stock levels translate into revenues that are broadly similar in the scenarios to the baseline if not a little higher by the final simulation years (e.g. year 25), Fig. 4.

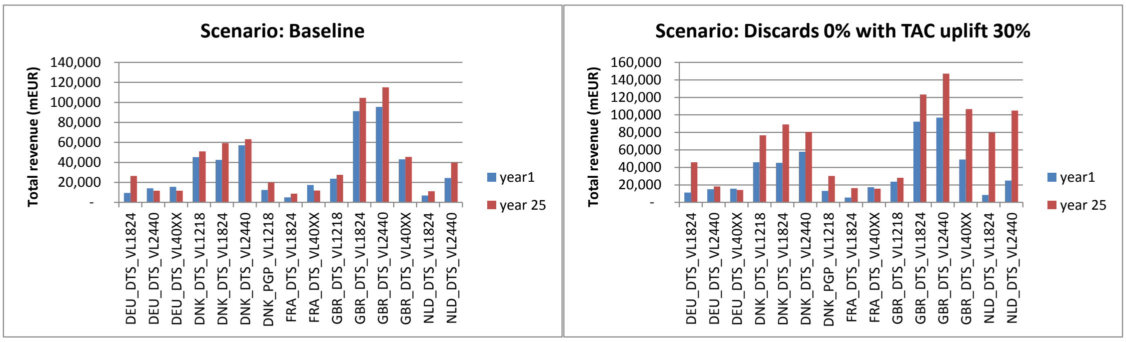

Fig. 4. Total revenue by fleet in years 1 and 25 for Baseline (left) and Scenario 1 (right).

Total net profit on the other hand shows a stark contrast between the baseline and the scenarios. If fleets continued under current policy and behaviours then the baseline indicates that profit is likely to decrease over the simulated period (see Fig. 5), however in scenario 1 the reduction in vessel numbers with increased fishing opportunities shows a dramatic increase in profits by the end of the period.

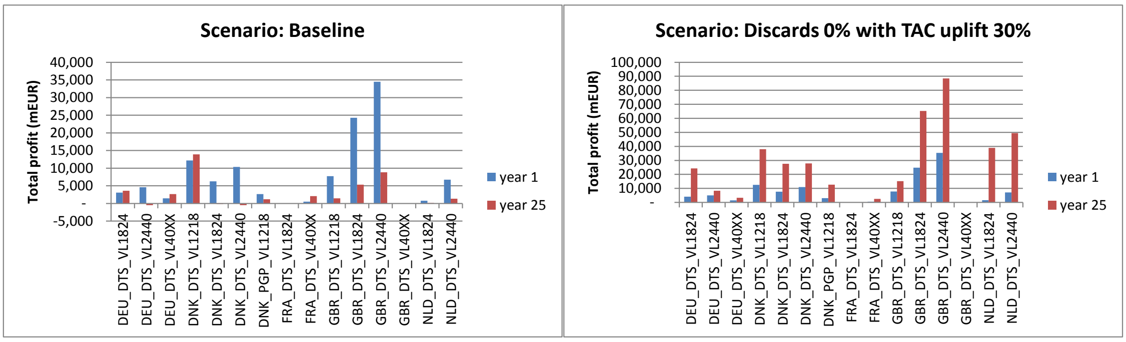

Fig. 5. Total net profit by fleet in years 1 and 25 for Baseline (left) and Scenario 1 (right).

This view continues across all years (see Fig. 6) where all fleets show a steady increase in profits over the period modelled in the scenarios, contrary to the Baseline which indicates a steady decrease.

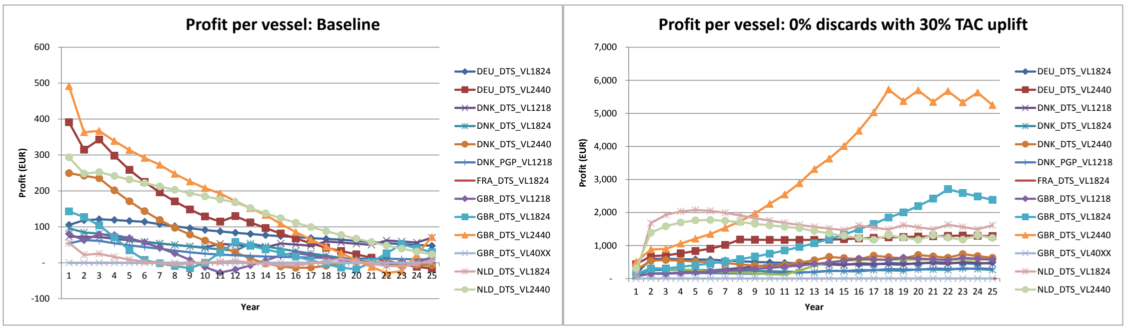

Fig. 6. Average net profit per vessel by fleet in Baseline (left) and Scenario 1 (right).

The scenarios modelled show preliminary results for implementing a relatively strict discard approach of 0% discards with 30% TAC uplift, taking account of estimated loss in single species discarding. This results in the likelihood of significantly less vessels and significantly less effort in the North Sea demersal fisheries primarily due to choke species dominating whether a fleet can participate in the fishery or not. The model as implemented uses a view of current catch composition. However, catch composition is critical and will undoubtedly change over time as the policy grows to align better to catch opportunity. The results here could therefore be viewed as worst case impacts on the fleets under the modelled scenarios. Catch composition may change through re-allocation of quota at source or perhaps through the market (buying and selling quota). It is also worth noting that there may be opportunity to trade-off the short term impact on fleets with slightly less improvement to stocks. This trade-off would slow both the reduction in fleets and the improvement in stock levels. Total landings (and revenue) is greater across 25 years, implying supply is relatively assured (see Fig. 7)

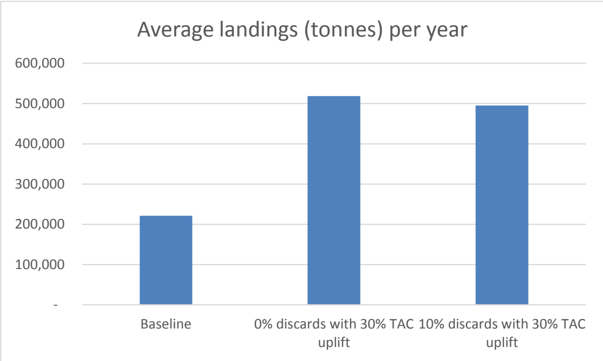

Fig. 7. Average biomass difference between scenarios and baseline across 25 years modelled.

DISCUSSION AND CONCLUSIONS

In the "new world", the aim is that landings equal catch whereas in the "old world" landings equals catch minus discards. There is the potential to discard under defined exemptions but basically the premise is that unwanted catch is landed. There will be several issues to overcome, and enforcement will likely feature strongly. In recent initiatives and Catch-Quota trials (e.g. MMO 2012), practical investigations have been put forward, for example Scottish conservation credits promote:

- using more selective fishing nets and other gear,
- observing temporary closures, or seasonal closures, and
- CCTV scheme and observer programmes to monitor vessels on agreed trials.

In further trials the UK (with DK & DE) have experimented with a cod catch-quota program with up to 30% quota uplift and additional days where:

- all caught fish are recorded and all cod caught count against quota,
- all cod caught shall be retained on board and landed, and
- once a vessel's cod quota is reached it must stop all fishing practices that can catch cod.

There are likely to be penalties of not meeting the landings obligation regulation. Currently when landings exceeds quota this is imposed on the vessel then the region and then the nation, with reduced quota in the following year. Enforcement and compliance have not been addressed directly in policy but will likely be left to Member States to implement.

Fisheries in Northern Europe in particular have been managed through single species assessment. For data and information to be provided for the landings obligation, it would seem that much more effort would need to be applied to multi species assessment and knowledge surrounding the catch of "unwanted" fish (e.g. previously termed discards). Much has been written on economic indicators but stock assessment still drives policy. However, with such a fleet focussed policy is economics set to play a more dominant role in management? If this is to be done then the economic data collected for fleets must be improved.

A discard ban matters. There are consequences on catches and economic performance as well as environmental impacts (e.g. birds, seals, ecosystem services). The direction of effects isn't necessarily clear. The Management Plan is critical and although in progress is still yet to be formally defined for North Sea demersal fisheries with only a year and half to go until implementation.

If the discard ban is rigorously introduced then fleets will be bound by choke species and catch composition will be 'uncovered'. Relative stability which is core to the CFP will no doubt be questioned. As a result, the question of, will the discard ban provide an approach to reducing capacity and managing fisheries that ITQs cannot in Europe evolve. Quota will be a valuable asset.

In past years, it can be observed in some instances that fishermen will pay up to the same price for a tonne of quota for a given species (e.g. cod) as they will obtain when landing that same tonne. There is already a multispecies effect on the market. When the discard regulation becomes a reality, this will undoubtedly be amplified. It has been suggested that quota price for choke species could be up to the level of the expected penalty for illegal (over-quota) landings (Hatcher 2014). This will only be the case if the penalty exceeds the benefit gained as a whole. In the short term, it could be expected that large vessels will outbid, potentially above what may be considered rational levels, to gain market share. In reality the discrepancy between businesses and market competitiveness will bring about significant change to the structure of the industry.

A criticism that could be levelled at some theoretical models of discarding that have been proposed is that they are self-fulfilling, that is factors included to measure profit maximisation of a firm will satisfy the conditions imposed on that firm. This could imply that not recognising the complexity of the activity will not produce an optimal outcome, and by a significant margin.

The regulators are (somewhat) aware of this and have as a result also introduced a number of additional features to the discard regulation, including quota flexibility, quota uplift and the de minimis exemption. The de minimis exemption appears to be specifically designed to deal help vessels and fleets balance their catch, especially where ‘choke’ species are present, to enable continuation of fishing for a time.

It is possible that under the new rules, target species quota will not be able to be fully caught as choke species dominate whether the fishery is open. Further, if swapping with other Member States is allowed, as previously, then relative stability, a core feature of the Common Fisheries Policy, may be impacted. It certainly needs regional coordination through the RACs. In many Member States (e.g. UK), it is unlikely given previous indications that tonne for tonne transfer will be allowed, i.e. there will be a penalty applied to the transfer across fleets, as well as transfer between pelagic and demersal (and vice-versa), similar to that currently applied to some quota transfers across species types.

Models and data are important for doing applied economic analyses of a discard ban. Empirical analyses using such models (e.g. Fishrent) could assist in giving the answers for a number of fisheries, analysing and evaluating what is useful and what might happen. For example considering changing behaviour with regard to selectivity, substitution, economic viability of fleets, learning across fleets and fisheries, and investment decisions and disinvestment.

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