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The Badminton project: D2 Report in the Badminton project work package 4: Socio-economic and institutional incentives for discarding

Case studies of trawl fisheries in Denmark, Greece and England and an evaluation of incentive framework

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**The Badminton project: D2 Report in the Badminton project work package
4: Socio-economic and institutional incentives for discarding**

**Case studies of trawl fisheries in Denmark, Greece and England
and an evaluation of incentive framework**

Eliassen S.Q., Papadopoulou N., Vassilopoulou V., Berner L.

October 2012



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0. Introduction

The Badminton project (Bycatch and discards: Management INDicators, Trends and locatiON) aims at developing the knowledge of discard patterns and factors in European fisheries, evaluating the efficacy of selective devices and other discard management measures that have been implemented in the past and finally improving methods to analyse, monitor and manage bycatch (unwanted catches) and discards in European fisheries.

WP4 focuses on the socio-economic and institutional factors that influence the discard behaviour of fishers. The first step in WP4 was to develop a framework seeing discard as a result of fisher behaviour embedded in institutional context, which influences the behaviour. This was developed in the working paper D1 in the project (Eliassen and Christensen 2012). This paper describes how the developed framework has been used for implementing three case studies of trawl fishery to get a deeper understanding of the fishers' discard behaviour and thereby discard levels and patterns. The results are further summarised in an article with focus on the evaluation of the framework which is expected to be published in the ICES journal of Marine Science.

This working paper consists of three parts:

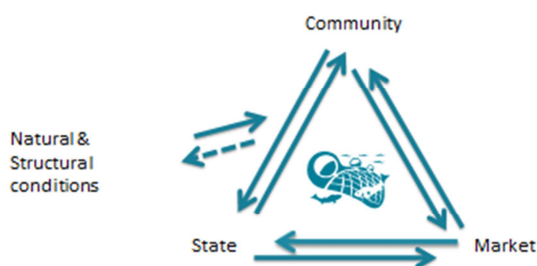
- A description of the methodology of case studies (based on working paper XX);
 - The list of factors influencing discard behaviour, which has structured the focus of the case studies
 - Description of the methodology used for the case studies, especially the interview method.
- Link to appendices containing descriptions of the three cases from Denmark, Greece and England.
- A discussion of general findings across the three case studies and an evaluation of the list of factors which potentially influences discard behaviour.

1. Methodology

The list of potential factors influencing discard behaviour

The basis for the case studies is an understanding of discard as a by-product of the fishing process. The process of discarding takes place in the sorting process on the vessels. What are caught are (partly) a result of choices made earlier in the fishing process and right up to the trip (choice of gear, fishing place and time etc.) as well as the strategic choices (choice of vessel, investments in quotas and catches and dealing with the equipment etc.). Therefore the discard level and patterns partly depend on the behaviour of the fisher. The behaviour is seen as a result of individual choices which are embedded in the institutional orders of Community, State, and Market and under the external conditions; natural and fleet structures etc., which in the short run for the individual is as external as the natural conditions (Apostle et Al. 1998, Scott 1995).

Figure 1: The model of the institutional embedded fishing practice. Fishing practise embedded in the Community, State, Market interrelation and the structural and natural conditions.



Departing from this approach a list of specific factors that potentially can influence the behaviour leading to discard in the fishing process is developed.

Figure 2: Specified list of factors which potentially influence the discard and selective behaviours.

Main area	General factors	Specific factors
Natural conditions	Stock related conditions	Mixed/single species fishery Natural changes in stock availability
	Condition for the fishing process	Seabed and other physical conditions Weather conditions
	Structural conditions – fleet structure	Fixed investments in vessels (and partly equipment)
Community	Dominant norms regarding discard	General view of discard Institutional knowledge regarding volumes, consequences etc. of the discard Social norm enforcement
	Identity	The fishers’ perceived roles in relation to the management system
	Learning	The fishers’ interpretation of the management system and dialogues with the management regarding the discard Individual and collective initiatives to learn

State	Regulations and measurements	Input/output regulation Technical measures (including spatio-temporal closures)
	Decision rules and procedures	Legitimacy of the fisheries regulation
	Communication structures	Formal and informal forums Communication "climate" - dialogue/position marking
	Control and enforcement	Interpretation of strength of control and enforcement Level of registered non-compliance
Market	Economic incentives	Market prices Interpretation of market pressure for certain "qualities"
	Tactical investments in technology	Fishing gear/equipment for tracing, handling and storing

The list of factors has been used as a check list for a study of fishers' interpretation and behaviours in regard to discard in the cases studies in Denmark, Greece and England. In the same process the relevance of the specific factors of the list has been tested.

Empirical basis for the case studies

In each case study, the specific factors of the list have been examined to see if, in this case, it has functioned as a driver for discard.

Some of the factors could be examined based on data available in desk studies: the scientific knowledge about the natural condition for the specific fishery (the mix of species and sizes and areas of appearance), the regulation of the fishery (the general mechanisms and specific measures for reducing the discard as gear specifications, closed areas etc.), and the general market conditions of the fishery. Further, to some extent the composition of the fleet and general use of the gear and fishing places are registered and available. Besides the framework conditions the desk research further documented parts of the behavioural outcome; e.g. compliance through registered violation of regulations as well as information on local history, organisations etc. which contribute to the understanding of norms and cognitive institutions among the fishers.

The registered discard from observations and test fisheries should work as background data. In the interview situation it should also have been used for getting a bit deeper into the question of discard, which in many relations is a political delicate question. By being open to the fishers' views on discard practise and then confront the fishers with the official discard data and thereby get the fishers' interpretation of the data.

Unfortunately it turned out that there were important time lacks in the discard data. Given the changed regulations and context the official available discard data was not useful for discussion of the present practice and any changes in this:

- In Greece the collection of discard data according to Data Collection Framework (DCF) for the Common Fisheries Policy stopped in 2008.
- In Denmark discard data is collected on a continuous basis. But the processing time is long and the latest approved data set for discard in Kattegat is from the year 2008. Taken into consideration the important changes in the fisheries and the regulation between 2008 and 2011/2012 (where the interviews were conducted) discard data was useless as a tool to confront the words of the fishers on discard practices and the registered data.

Not only has the project team regretted the lack of recent data; also the fishers would have liked to be able to document the claimed changes in discard practices.

1.1 The interview method

The desk research provided data of some of the factors. But more qualitative methods should be used to understand the fishers' perceptions and behaviour. Personal interviews have been the main input in regard to fisher behaviour and assessments in the Danish and Greek case, while the desk research mainly provided background and contextual information. In the English case three reports of interviews with fishers in NE, MW and SE England were used as the source. The interviews have been conducted by the researcher, mainly in one-to-one relation (as a group interview in one occasion). The interviews lasted 1-2 hours and were based on a semi-structured interview guide, which was slightly adjusted to the situation and developed on a few points during the process. The interviews were recorded and transcribed. The interviews were evaluated for any new information (concepts, reasoning etc.) and perspectives in the answering of the overall research question. The interview summaries were sent for comments to the interview person and discussed in a following telephone conversation where supplementary questions were discussed as well.

There are often discrepancies between words and actual behaviour (Schein 2004). Participant observation over time could solve this, but it is too costly for this context and interviews are used instead. The methodology of a single interview with each person (and in some cases telephone based re-interview) for 1-2 hours, and an eye for observation of general behaviour, attributes etc. during the interview visit allow a relative good insight into the fisher's view on his and his fellow fishers' fishing practices. The individual interview, combined with a range of interviews with fishers in the same fishery as well as written documentation of fisher behaviour (scientific reports, management reports, newspaper articles etc.) is assessed to provide solid information on the fishers' behaviour and considerations in relation to discard behaviour.

Nevertheless some of the theoretical identified potential incentives from the framework list, especially in the community sphere, are more or less intangible and tacit, maybe even invisible for the fisher embedded in the specific social context. Therefore it is most likely that the general view of discard, social norms in this regard and especially the social norm enforcement could be further developed using another methods with a higher degree of observation. A deeper knowledge about local social norms and mechanisms would

strengthen the basis for implementation. But as the social norms expectably are quite local specific a larger numbers of studies should be done to support implementation for larger areas. Such numbers of studies is outside the range of this project. A basis for such deeper study could be a socio-economic database of fishing communities, as proposed by the North Sea Women's Network (2007) based on their study: "Developing a socio-economic dataframe".

2. The case studies

The case studies are attached to this report as separate appendices.

2.1 The Danish case study

Appendix 1

2.2 The Greek case study

Appendix 2

2.3 The English case

Appendix 3

3. Discussion

Finally based on analysis of the case studies we will discuss findings across the three case studies and evaluate the list of factors which potentially influences discard behaviour.

3.1 Analysis of the case studies

The case study description is structured by the list of factors. The specific factors are described under the main areas – Natural conditions, State, Community and Market. For the specific factors which appeared in the data (desk research and interviews) the way they influence the behaviour is described and discussed. The influence of the factors is summarised in a table where the factors are divided into main areas and how they drive for a high discard behaviour or a selective (or lower than average) discard behaviour. The tables show which factors influence the discard behaviour (and how), though not in any way assessed in a quantitative way. Besides summarising the influential factors in each case, these tables were used for discussing the relevance of the elements (the specific factors) of the list.

The purpose of the cross case analysis was to find similarities or differences in the behaviour and the patterns of interrelation between factors. A direct comparison would not be relevant given the differences in geographical, historical and cultural contexts and management systems in use. In this case a comparison of which and especially how the factors influence discard behaviour combined with a more holistic reading of the case descriptions gave basis for finding patterns across the cases.

3.2 General cross case findings

When adding the case studies it is obvious that factors from all four main areas; natural conditions as well as community, state/regulative and market had important influence at the discard level and pattern. But at the level of specific factors the context dependency is evident; No quota related discard in Greece because

quotas are not in use in the Mediterranean Sea. Discard problems in the mentioned English fisheries related to catch composition rules and mismatch between quota and abundance for whiting, which was not mentioned in the other cases etc. Despite the differences in context there are similarities and patterns in the interrelation of factors which can provide general experiences.

The cases showed a lack of a common definition of what the discard problem is. There is not necessarily fully accordance between the fishers, not even within each case. Further the fishers have no clear understanding of what is meant by discard, when the management system or general public urge them to reduce or ban discard. In Greece the fishers hardly saw discard as an issue, while in England and Denmark discard was a focus point also because it is a hot political topic and an issue in the recovering plans. Still in England and Denmark the fishers only see certain fragments of the discard as a problem – an understanding that can differ from other stakeholders like politicians and Green NGO's. A common understanding of what the discard problem is – or at least clarity of the positions – is probably a precondition for cooperation towards a reduction of discard.

The fishers perception of what the discard problem is highly, but not only, formed by a market perspective; discard of fish which could be sold is waste. This is the signal from especially the English fishers and can be seen in Greece, where market and enforcement conditions allow landing and selling of fish also under minimum landing sizes. The discard of small individuals of commercial species is also often seen as a problem, thus for the future fishery. The fishers' views on the rest of the discard fractions in an ecological perspective are more complex. Some fishers have some consideration of this as a disturbance of the ecological balance, but they often see other factors as equally important for this balance; consequences of other fishery activities, pollution from land or sea, invasive species etc. Other fishers see the catch and discard of some species as a way to reduce the predators of competitors to the commercial species, and maybe even see the discard as a way to feed the commercial species (nephrops).

The fishers in the English and Danish cases have taken initiatives to develop new regulation tools as well as new gear, with higher selectivity as one of the goals. The same type of fisher initiatives regarding discard and selectivity have not been reported from Greece. The explanation is probably mainly the political and managerial focus on discard. While there is a limited focus on discard in Greece it is an important political issue in England and Denmark and an important element in the recovering plans in these two countries. Among other things by addressing reduction of unwanted catches and discard the fishers try to avoid regulative measures which can threaten their fishery e.g. large closed areas, strong limitation of days-at-sea etc.

Looking at the cases finally illustrates that the effect of one factor often depends on the interrelation with other factors. In the Danish case the discard problem of nephrops was due to a mismatch between minimum landing size (MLS) and the actual mesh size leading to discard of under-MLS nephrops. The exact level of discard is not clear as discard data does not yet cover the more selective trawls enforced in the last couple of years. The current MLS is supported by the fishers despite the discard level, as they fear the market will erode if the small nephrops reach the market. Further the Danish nephrops fishery showed a low nominal level of discard of cod (which is in focus for most of the Kattegat regulation). This is a result of both a low abundance of cod to the quota and to the transferability of quotas which allows the fishers in an easy way to buy supplementing quota rights if necessary. The English case covers three fisheries with different problems; though the most important discard problems were discard of especially whiting due to

a mismatch between stock abundance and quotas. The lack of total quota means that even a well-functioning quota market cannot reduce the discard level. Further catch composition rules resulted in discard of fish which the fishers had quota for, if caught in a wrong combination of species. In the Greek case discard was hardly felt as a problem – for fishers or public. Apparently there was a low discard level for all marketable species as the market in general accepts small sized fish (even below the MLS). A low level of control and enforcement of the MLS regulation meant that the discard of marketable species was an insignificant problem, whereas non-marketable fish was discarded. These examples show that the specific interrelation between stock situation, regulation and market leads to the specific pattern; MLS is wanted by the fishers in Denmark and not respected in Greece due to the market in both cases. Transferability of quota rights reduces quota related discard in the Danish case, but cannot in the English cases due to sufficient total quota in one case and not in the other. Therefore, the interaction between case specific factors from the three spheres will, if ignored in the process of developing mitigating measures, make the final outcome of the measures unpredictable. A specific measure in isolation tends to create a certain incentive. But other factors can strengthen the incentive or counteract it.

4. Evaluation of the framework list of factors

The framework of the case studies was the list of factors which potentially influences the discard behaviour of the fishers. By focusing on behaviour we see the fisher not as an instrument for drivers, but as an actor in developing the specific fishery and therefore also discard pattern. The factors of the list are therefore both institutionalised incentives leading to certain behaviour and framework in which new mitigating measures will work. The factors influence can lead to different types of behaviour, but could *potentially* be used for the purpose of this context; to develop mitigating measures to reduce discard. As a tool for mitigating discard the list should therefore be seen as a checklist in an analysis of possible drivers for each specific situation. The list is evaluated based on the three case studies; especially the summarising tables in the description indicating which specific factors influence discard behaviour in a higher or lower direction. It is seen that the importance of the individual factor had a varying importance between the selected cases. In these cases some of the factors have not been seen as influential factors. As the cases are not representative for all fisheries, they might have influence in other cases (not studied here) or they might even just need other more anthropological methods to be identified as influential. Therefore the list should be further developed when used in other cases.

The specified factors of the natural conditions were seen in most cases. A higher focus on the actual fishing practice, including observations at sea may have developed the importance of e.g. weather conditions, which were hardly mentioned as important for discard. Based on the present data we cannot say if weather conditions could be decisive or just a marginal factor.

The community factors played important though more intangible roles in the cases. As mentioned the norms regarding discard influence the practice, but they would also be the basis for mitigating measures or actions. The norm regards the understanding of which fractions of the discarded material the fishers see as a problem and what is not seen as such. Another aspect concerns the strength of the dominant norm; if it has been developed to a tacit level or there are explicit conflicts in defining the norm, seen as social enforcement of the norm on norm-breakers. In the cases no examples of social enforcement in regard to discard were mentioned, although there could be such examples only hidden for the interviewing

“stranger”. The identity in relation to the management system is a background factor rather than a direct factor on discard behaviour as no one sees themselves as “discarders” or “non-discarders”. In these cases the focus on identity revealed that the fishers did not see themselves in total opposition to the management system. Those seeing themselves as real partners to the authorities had an expectation of being able to make agreements on implementation of certain measures that the fishers would comply to and afterwards evaluate before new were introduced. They were often disappointed due to a flow of new measures. The learning factor could lead to a higher or lower discard level – depending on the learning and knowledge focus. Many of the interviewed persons had participated in research fisheries with scientists and used phrases and arguments from science in describing their understanding of the sea ecosystems and the influence of fishing and other activities. This learning enables a beginning convergence between fishers and scientists and forms a possible basis for dialogue on discard issues. At the collective level there were examples in England and Denmark of fisher initiatives to develop new selective gear and new management systems which included fisher responsibility to adjust the fisheries in order to avoid certain types of unwanted catches and discard. No such initiatives regarding discard were reported from Greece. The specific factors within the community main area therefore seem to be relevant for understanding the background of discard behaviour and not least the context for implementation of mitigating measures.

The state factors focus on the formal institutional structures as well as the interpretation of these. It is obvious that choice of input or output regulation influences discard patterns, as there is no quota related discard in an input system. Also the technical measures influence discard patterns; the cases revealed several examples of discard initiated by technical measures as catch composition rules, minimum landed size regulation etc. The Greek case though showed that a low acceptance to the MLS rule, combined with low enforcement (and a good market condition for small fish) resulted in low MLS related discard of marketable fish. Thereby also decision rules, especially the legitimacy of the regulation as well as the control and enforcement status have shown to influence the actual discard level and behaviour. The communication structures enable dialogue and learning regarding discard. The informal forums are constituted by the interaction between fishers and authorities in control or scientists in research fisheries. The formal forums are at an organisational level, where fishers’ organisations participate in advisory panels etc. The communication structures thus seem to influence discard indirectly only by function as a way to communicate understandings of ecosystems and discard (as well as other topics) between the fishers and managers/scientists. As a tool for mitigating measures the formal and informal communication structures could be of importance for developing and implementing discard reducing initiatives.

Finally the market factors are of high importance for the discard level and behaviour. Clearly the fishers wanted to discard the parts of the catch which could not be landed and sold without a loss. The case studies showed that not only market prices (at auctions or other types of markets) are of importance. Factors as the risk related to strong fluctuating prices and not least costs influence the fisher behaviour. The direct costs of handling, landing and selling the catch were considered, but also indirect costs as the work load of handling low priced or small quantities of fish which would only bring a low net income. It is not clear how important the interpretation of risk and indirect costs is for the discard behaviour. Never the less the specific factor should be “interpreted income from marketing the catch fractions” rather than just markets prices. Surprisingly the market pressure for certified fish eventually caught under low discard was not mentioned in the cases as a factor behind changed behaviour, though it might be seen as a part of the public pressure on the fishers in general. The factor of technical investments seems very relevant as the

trawl types are a commonly used technical measure in order to reduce discard. Other factors as tracing equipment and storing capacity were not mentioned in the cases as factors behind discard, but could eventually turn out to be influential if the interviews or observations had been even more focussed on the actual fishing practice, as the effect of tracing equipment is natural and therefore tacit for the fisher. Several fishers pointed out that the importance of sharing experiences of good fishing places within the group was very important though. Some fishers declared that in order to limit sorting time and effort they preferred some areas with less unwanted catch. Some of the specific factors of the market area should be reformulated and others should be further surveyed to assess the level of importance for the fisher behaviour. Nevertheless all factors in this main area seem to be relevant, though with adjustment of the formulations.

As a conclusion the list highlights factors that in isolation, but especially in combination, influence discard level and behaviour. Some factors directly influence the present behaviour, while others set a framework for an actual behaviour and the basis for any fisher involvement and active role in an attempt to develop and implement mitigating measures. Some of the specific factors of the list have had less importance in the three case studies (social norm enforcement, handling and storing capacity), but could have been important elsewhere. Using the list in the case studies also illustrates that some of the factors should be further developed; clarifying the discard/discard problem definitions among the stakeholders, the price factor should include interpretation of the market and potential net income as this is what influences the discard behaviour. The list therefore should be further developed and validated through use in other case studies or use in preparation or implementation of mitigating measures.

For development of mitigating measures the above demonstrates the importance of taking the factors mentioned into consideration, in isolation as well as the possible effect of interrelation between two or more factors.

- Across the cases all main factors are of importance for discard behaviour. But not all factors have influence on all cases.
- Even though the same factors influence the discard behaviour in the cases, the outcome depends of the specific interrelation between the specific effects of the factors.

For pre-assessments, evaluations or development of mitigating measures, the whole range of potential influential factors should be included in an analysis.

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Appendix 1: The Danish Case Study: The Kattegat nephrops trawl fishery

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Introduction and summary

The case description is structured around the list of factors which might function as drivers for the discards and selective behaviours. As the real world is more holistic than the analytic categories some theoretical identified factors are discussed more than once.

The data for the case study origin from desk research, to some degree from conclusions from previous work packages of the Badminton project and personal interviews with fishers and from 4 ports around Kattegat; Vesterø and Østerby (both at the Island of Læsø), Strandby and Gilleleje (in total 14 fishers including the auction leader).

The interviewees are chosen in corporation with the chairman of the local Fishermen's Association. The fishers are all trawlers with their main activity in nephrops fishery in Kattegat. Several of the fishers participate occasionally in research related fishery (test of trawl, stock assessment or discard observations). Most interviews took place in the fishers' private homes or in the facilities at the port. The interviews lasted 1-2 hours. In one case we chose to have a group interview with three fishers, the chairman of the local Fishermen's association and the leader of the local auction. In most cases (depending on the agreement with the interview person) the summary of the interview was sent for comment to the interview person and discussed in a following telephone conversation where supplementing questions were discussed as well.

Summary: The most important factors

The identified factors function as drivers behind the discard behaviour. Some factors drives in a certain direction in regard discard level. For others the direction is strongly influenced by the context, the interaction with other factors. The table below summarises the findings from the case study, distributed on the natural conditions as well as the three types of institutions (state, community, market). It is briefly mentioned how the factors contribute to behaviour of high discard level or selective/low-discard behaviour.

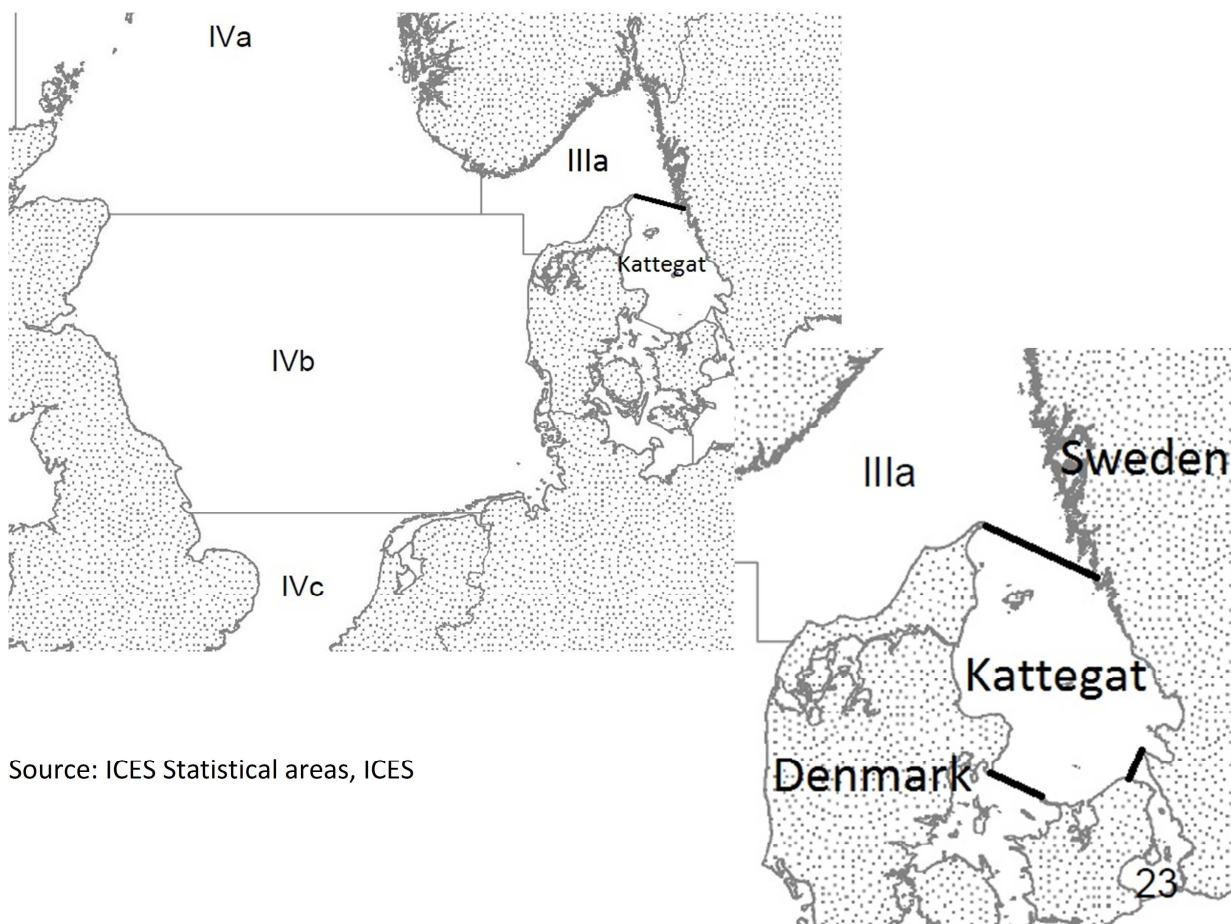
Table 1: Summary of factors driving toward a higher or lower discard level.

	Drivers for high discard behaviour	Drivers for selective/low(er) discard behaviour
Natural conditions	<ul style="list-style-type: none"> *Mixed fishery – unavoidable catch of unwanted species or sizes *Bottom trawling – relative high level of unwanted catch 	
State	<ul style="list-style-type: none"> *MLS regulation and landing ban of undersized *Landing and administrative control – low possibilities for black/undersized landings *0-quotas for protected species 	<ul style="list-style-type: none"> *Transferable quotas and quota pool enable buying/renting supplementing quota for marketable non-target catch *Sufficient cod-quota to actual abundance *Compulsory use of selective gear
Market	<ul style="list-style-type: none"> *Low prices on certain flatfish (unmarketable) *High cost (money and effort) on landing of low volumes relative to auction prices 	<ul style="list-style-type: none"> *Lowering cost (in money and effort), by avoiding unwanted catch and sorting *Buying/renting supplementing quota reduce high grading

		*Eventually local black markets for undersized nephrops (not documented)
Community	<p>*View on discards</p> <ul style="list-style-type: none"> - Some of it is OK - feeding nephrops - Catch of unwanted species and sizes is partly due to unbalanced fishing pressure based on “stupid” regulation <p>*Feeling of being unable to fulfil all regulations anyway – a risk of a loose relation to compliance</p>	<p>*Interest in trying new (and selective) gear</p> <p>*View on discards</p> <ul style="list-style-type: none"> - High grading (over MLS marketable fish) is waste <p>* Wish to be legal in everyday practice</p> <p>* Informal sharing of knowledge of fishing grounds with high unwanted catch (partly)</p> <p>* Initiatives to develop locally adjusted management systems (effort regulation/selective behaviour – so far failed)</p>

Natural conditions for the Kattegat nephrops trawl fishery:

Kattegat is a minor sea area between Denmark and Sweden (30.000 square kilometres). Kattegat is ICES area IIIaS, while Skagerrak is IIIaN, together area IIIa.



Source: ICES Statistical areas, ICES

The main commercial species in the Kattegat is nephrops, sole, herring, lumpfish, brill, plaice, turbot and cod, which totals more than 95 % of the landing values. But 51 species with Kattegat as origin is registered landed in Danish ports in 2011. It is therefore a relatively mixed fishery.

The registered discard situation

The last available discard data for Kattegat covers the period 1998-2008. The Kattegat data are processed by DTU-Aqua. In this regard the data origin from the DTU-Aqua contribution to the Badminton project (Imares 2010). Appendix 1 below shows discard for all discard data for four types of fisheries. The nephrops trawl fishery is the main part of the "OTB-CRU"; the first row in column in the discard table, the bottom otter trawl for crustaceans. The data do not inform about the reason to discard; it is not specified which parts of the discard are below or over the Minimum Landing Size, or if over-MLS sizes are discarded due to lack of quota, low prices or due to damaged fish. But the relation between number of individuals and weight gives an indication of the general pattern of discards.

Table 2: Summary of the mean numbers (Nb) and weights (Wt, in kg) of selected species per hour per trip for nephrops trawl (the bottom otter trawl for crustaceans) for Kattegat (IIIa, IIIIn) based on data 1998-2008.

	Discard		Landing	
	No	Wt (kg)	No	Wt kg
Total kg/h/trip	1189,2	63,1	352,7	72,1
Of this: Nephrops	873	20,9	288,7	16,4
Cod	29,5	8,8	4,2	8
Saithe	9,7	7,7	21,9	28,2
Haddock	27,2	5,1	7	4,8
American plaice (Hårising)	97,4	4,7	0,1	0
Dab	54,9	3,4	1,4	0,4

These six species cover more than 80 % of the registered discards from 1998-2008. Based on the average weight of the discarded individuals, the discards seem mainly to be undersized individuals. The exception is saithe, where the difference between average weights for landed and discarded is below a factor 2. This indicates a possible discard due to lack of quota.

It is important to note that these data covers the period 1998-2008. As seen below the regulation on closed areas and gear use has changed considerably in the last years. Therefore the fishers claim the current level of discards is lower than the registered – and probably a different pattern. This is supported by the latest and not yet processed discard data (according to personal information with DTU Aqua).

The fleet

The dominant commercial fleet fishing for nephrops in Kattegat is minor trawlers of 10-18 m in total length. The crew often consists of 1-4 crew members including the skipper. The trawlers often also hold quota for fisheries in Skagerrak or the North Sea (for fishers in the northern part) or in the Baltic Sea (fishers in the

southern part of Kattegat). For most of the Kattegat fishers, nephrops is the main fishing activity and income source.

Figure 1: 2 Kattegat nephrops trawlers; H79 Tiki (steel 17 m) and FN272 Tina Malene (wood 14 m),



Source Fiskerforum.dk /MC and /G. Vejen

In Kattegat both side trawlers and stern trawlers are used. In 2011 53 trawlers was registered in the four ports investigated, half of them side and half of them stern trawlers. The length of the vessels differs; 6 are below 12 meters, 14 vessels are 12- 15 meters, 20 are 15-20 meter and 14 vessels are over 20 meter. In general the vessels are relative old. In the last years, the investments seem to have focused on buying up old vessels with quotas. In that case the best vessel (often the newest) is used for fishery, while the other is sold or scrapped.

Generally the crew members are paid by shares of the landing value. The specific shares differ between the vessels. Not least the huge investments in vessels and quota have led to a larger share “to the boat” and similar less share of the total landing value to be shared among the crew. An example was given: First the cost of oil is subtracted from the total landing value from the specific trip with the nephrops trawler. Of the rest 55 % is allocated to the vessel. The rest (45 % ex. oil) is shared between the three crew members (in this case the owner was skipper and therefore one of the members).

State: The regulation of the Kattegat trawl fishery

The Kattegat trawl fishery is regulated by the general EU regulation based on quotas, later supplemented by effort (days-at-sea). A range of technical measures are in use; minimum landing sizes (MLS), detailed gear restrictions, closed areas (temporary and more permanent) etc. Regarding discards the fishers are obliged to discard fish under MLS and fish for which they do not have quota. At the other hand they are obliged to land fish over MLS for which they have quota (ban to high grading).

First, the section focuses on the quota regulation. Second the cod recovery plans will be presented with the different regulative measures they consist of. Finally the fishers’ general considerations regarding control and legitimacy of the regulations system will be discussed.

Catch and quota development

From 2000 to 2011 there have been important changes in quotas allocated to Danish fishers in Kattegat. The cod quota was in 2001 only 3 % of the quota in 2000, whereas the quota for nephrops has remained stable and higher for some years.

Table 3: Quotas for Kattegat*, selected years and species, in tons.

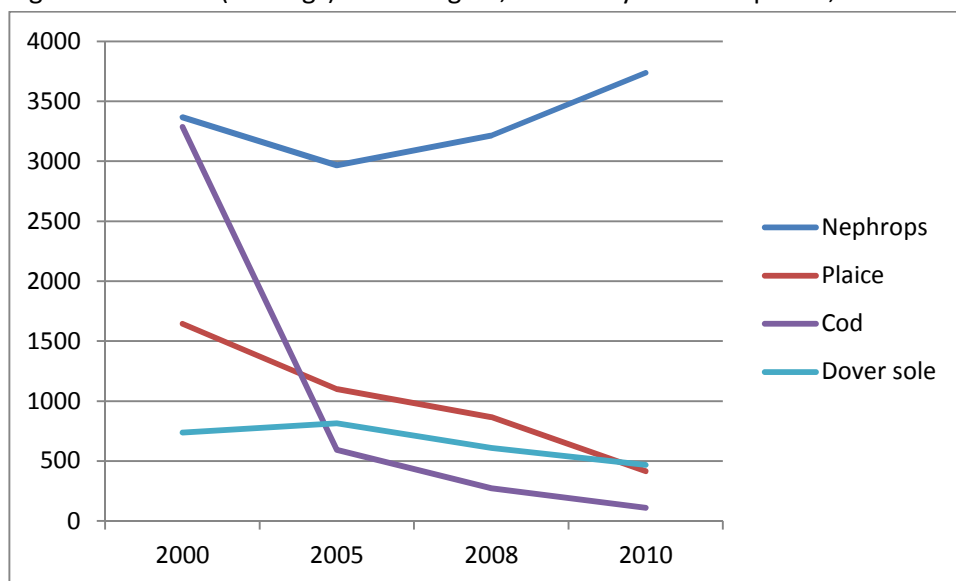
Quota (t)	2000	2005	2008	2010	2011
Nephrops	3665	3454	4039	4197	3800
Plaice	2490	1691	2131	2039	1769
Cod	4320	615	465	270	118
Sole	865	803	869	664	704

*The quota for nephrops and sole is for Kattegat and the EU-u-zone of the Baltic (ICES 3A/BCD). Quotas for plaice and cod is Kattegat (ICES 3AS) only.

Source: Ministry of Food, Agriculture and Fishery 2001, 2006, 2009, 2011, table 2.2.

The registered catch shows an even higher importance of the nephrops as the quota for cod and plaice is only used at a low level in 2010-2011 (20 and 41 % respectively), Figure 2. There has been a clear change in the catches towards dedicated nephrops fishery.

Figure 2: Catches (landings) for Kattegat*, selected years and species, in tons.



*The quota for nephrops and sole is for Kattegat and the EU-zone of the Baltic (ICES IIIA/BCD). Quotas for plaice and cod is only Kattegat (ICES IIIAS).

Source: Ministry of Food, Agriculture and Fishery 2001, 2006, 2009, 2011, table 2.2.

Vessel Transferable Quotas in the demersal fishery

Based on experiences from an ITQ system in the pelagic fishery, the so called Vessel Transferable Quota Share system (VTQ) was introduced in the demersal fisheries in 2007. The quota shares was allocated freely to the vessels (and their owners) based on a 3-year historical record. The quota shares can only be sold with the vessel. However, this limitation has been loosened during the last years as part of the quota can now be sold independently of the vessel. The new owner can transfer the quota to another fishing vessel in

his possession. If the vessel is purchased by more than one person, the quota can be split between the buyers. The transferability of quotas to other vessels has led to a considerable reduction in the active fleet (Eliassen et al. 2009).

As a part of the VTQ system a new institution, the VTQ pools, was introduced. The fishers can on pool their quotas on a voluntary basis, and they can be transferred in swaps, leasing or lending arrangements between vessels belonging to the same pool group. The exchange arrangements are relative simple within the pool. The VTQ-pools use an on-line system to conduct trades (puljefiskeri.dk). Together with private brokerages, this provides an efficient market in which the government does not participate (Alexander 2011).

Quota related discard

As noted in the working paper and in the WP 3 reports, one of the possible drivers for discards is quota related discards. This is either legal (obligatory) discards if the fisher has no quota for the specific species or illegal discards (high grading) of fish which can be legally landed, but of various reasons is low priced. High grading is a way to get a higher average price for the available quota. In both cases a mismatch between the catch and the quota drives the discard behaviour. High grading of other than quota reasons will be discussed in the section regarding market drivers.

All the interviewed nephrops fishers claimed they had sufficient quota or were able to rent more within the quota pool, if needed. As they did not expect to reach their individual quota level for (almost) any species, there is no incentive to discard fish over the minimum landing size – due to lack of quota or to optimise the income from the individual quota; all catches over MLS could be landed and sold. Especially for flounder this is not always the case, as described in the market section below.

The claim by the fishers that quota is not a limitation and driver for discards, is generally supported by the official registration of use of quotas for vessels under the FKA system. As seen in the tables below, only 78 % of the nephrops quota for Kattegat, Skagerrak and the Baltic Sea was used in 2011. No quota pools were near a full use. This means that the fishers were not forced to discard nephrops due to lack of quotas. At least they had the opportunity to rent the necessary quota.

Table 4: Registered use of nephrops quota in Kattegat, Skagerrak and the Baltic Sea 2011. Quota pools.

Quota pool	Share 0/00	Total quota kg	Registered catch kg	Unused quota kg	Unused quota %
6618 - Hanstholm Puljeselskab Aps	402,28	1.451.099	1.182.589	268.510	19
6619 - Foreningen StrandbyPuljen pulje 1	306,26	1.034.750	811.263	223.487	22
6630 - Bælternes Puljefiskeri	93,55	367.252	278.834	88.418	24
6637 - Skagen Fiskeriforening	73,39	253.887	180.578	73.309	29
6658 - Læsø Fiskeindustri	81,27	298.544	211.641	86.903	29
6660 - Dansk Puljefiskeri	75,44	289.544	217.941	71.603	25
All quota pools	1032,19	3.695.076	2.882.846	812.230	22

Table 5: Registered use of cod quota in Kattegat 2011. Quota pools.

Quota pool	Share 0/00	Total quota kg	Registered catch kg	Unused quota kg	Unused quota %
6618 - Hanstholm Puljeselskab Aps	477,65	55.327	38.516	16.811	30
6619 - Foreningen StrandbyPuljen pulje 1	243,34	31.253	25.164	6.089	19
6630 - Bælternes Puljefiskeri	92,01	11.567	6.873	4.694	41
6637 - Skagen Fiskeriforening	43,42	6.555	3.300	3.255	50
6658 - Læsø Fiskeindustri	70,84	11.019	8.453	2.566	23
6660 - Dansk Puljefiskeri	72,28	6.698	5.698	1.000	15
All quota pools	999,54	122.419	88.004	34.415	28

Source: Ministry of Food, Agriculture and 2012, IOK- og FKA-fartøjers andele og landinger.

For cod, which is the target for the protection measures, it is more or less the same picture as for nephrops. Only 72 % of the quota is fished, no quota pool is close to a full use of the available quota within the pool. Still the fishers emphasise that even today the quotas are so small for many vessels that even a single trawl haul could take the cod quota for a whole year, if the trawl by “accident” hits an area with many cods. A fisher gave an example showing this and the low importance of the cod in the total fishery: Last year the vessel caught 17,000 kg nephrops and 1,300 kg cod. This was caught during 160 days-at-sea with 3-4 hauls a day - an average of less than 3 kg cod pr. haul. This vessel only held a 900 kg quota for cod this year. The quota for the remaining 400 kg cod was rented from other members of the quota pool.

A further reduction of the quota to a close-to-zero quota could, according to the fishers, lead to the discards of cod only based on accidental catch. This is what the fishers realise today for the spurdog which has a 0- quota in Kattegat. There are occasional occurrences and accidental catches of spurdogs in the area.

The fishers were angry at a system where good and high priced fish had to be discarded because no catch and landing is allowed at all.

Other species are registered for larger areas; haddock for Kattegat, Skagerrak and the Baltic Sea, and saithe for the North Sea, Kattegat, Skagerrak and the Baltic Sea. It is not possible to assess the quota use for Kattegat based on these data.

The cod recovery plans and the portfolio of technical measures

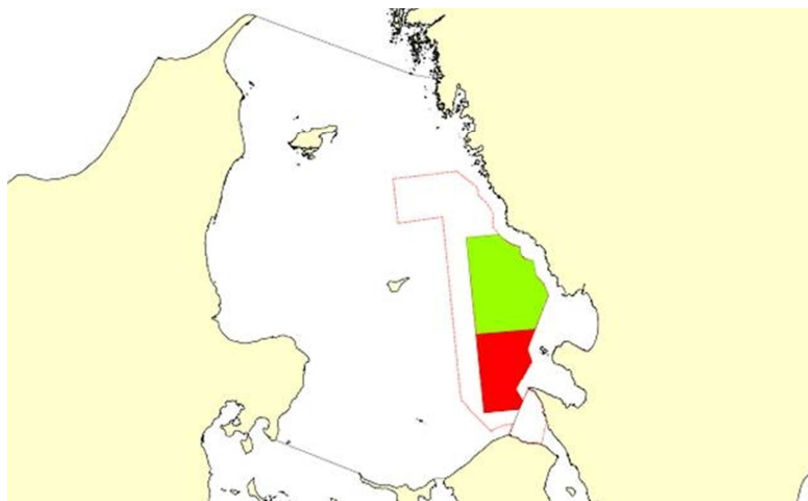
For protection of the cod juvenile the minimum mesh size in cod ends in the Kattegat trawling was raised from 60 to 70 mm in 1989 and to 90 mm in 2005. The 2005 change was a part of the cod recovery plan of 2004. This consisted of new regulations regarding limitation of TACs (and changes between years), limitation of fishing effort (reduced days-at-sea) and new control measures, among these requirement of notification of landing location and estimated volumes two hours before arrival to one of the accepted landing ports for cod (Council Regulation (EC) No 423/2004).

The regulation of fishing effort took form as regulation of days-at-sea. The days at sea were fixed to a certain level depending on type of gear. For the EU trawlers in Kattegat using 90 mm trawl the yearly days-at-sea was at 108 in 2005, later decreasing to 71 days. If the trawl was supplemented with a 120 mm square-mesh window in the top panel, the maximum days-at-sea was increased by 30 (and later 36) days a year. Use of a sorting grid gave free days-at-sea (Com(2005)27, com(2006)51 and com(2007) 41). The 120 mm top panel was generally in use after few years, while the sorting grid has never been in use by Danish fishers (Madsen and Valentinsson 2010).

The regulations following the cod recovery plan of 2004 did not lead to the intended reduction of fish mortality and rebuilding of the cod stocks. A new regulation (EC regulation (EC) No 1342/2008) thus replaced the 2004 regulation. This regulation further strengthened the fishing effort limitations and procedures for setting of TACs. If the stock is predicted to be below the minimum spawning biomass, the fishing mortality should be reduced by 25 % a year. In that case the TAC and the fishing effort should be reduced with the same percentage. However, the plan also opened for additional fishing effort for highly selective gear and cod-avoidance fishing trips. The member states could take new mechanisms in use, which in the Danish context lead to the introduction of a protection of the cod in the spawning period (February, March and April), where the numbers of days-at-sea counted 2,5 for each actual day.

Danish - Swedish bilateral agreement on closed areas in Kattegat 2009

As a supplement to the EU cod recovery plan the Danish and Swedish governments signed a bilateral agreement regarding closed areas for cod fishery in Kattegat and the northern part of Oresund. This plan was also in effect from January 1 2009 and will be evaluated after three year.



Three types of closed areas were agreed on:

Permanent closed area (marked with red): Identified as the most important spawning area for the cod. It is closed for all types of fishery all year.

Closed area (green): Closed for all type of fishery (except caves for nephrops) in the period January to March. Open for fishery using special selective gear the rest of the year.

Source: Ministry of food, Agriculture and Fishery 2008.

Seasonal closed area (brown line): Closed for fishery with non-selective gear from January to March and open rest of the year.

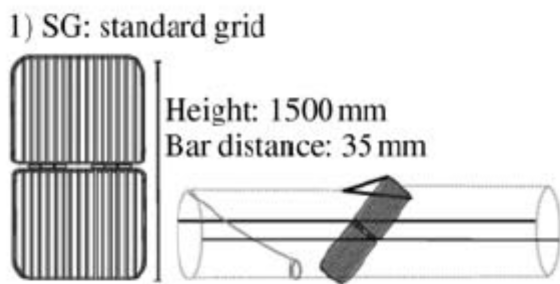
From 2009 new types of selective trawl have been developed and tested. For 2012 six types of trawl is allowed (depending of area and time of the year). All are using 90 mm diamond mesh in the cod-end. Trawl based on 2 or 4 panels with a 180 mm square mesh escape window or a 4 panel trawl with a 270 mm

diamond mesh escape window (Ministry of Food, Agriculture and Fishery 2011b). The special selective gear to use in certain periods in the brown and green closed area is trawl with sorting grid, the SELTRA 300 and the topless trawl. This leads to six different types of trawl to be used in Kattegat depending of zone and time of year (Ministry of Food, Agriculture and Fishery 2010b).

The development and test of the selective trawl took place in a working group formed after the agreement was signed. Fishers from Gilleleje proposed adjusting and using a few older types of trawl; a plaice trawl used in the Baltic earlier and a so-called “German trawl” originally used for saithe in the North Sea. But two other new types of trawl were developed; the topless trawl and the SELTRA 300 together with the so-called Swedish grid. These will be described below based on Madsen and Valentinsson 2010.

The sorting grid is placed before the cod-end with the grid in a position which allows the nephrops to bars with 35 mm distance and lead fish of larger size to escape from a window above the grid. This is not used by Danish fishers, as they claim there is a high risk of blocking the grid with mud in the shallow waters of Kattegat as well as a high risk of being hurt in handling the grid, especially at the side trawlers (fisher interviews).

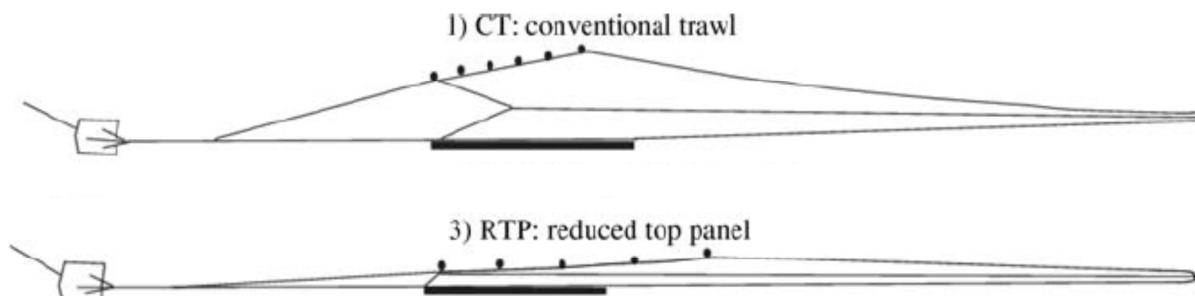
Figure 3: The Standard sorting grid in nephrops trawl.



Source: Madsen and Valentinsson 2010

The topless trawl is a traditional trawl, where a part of the top panel is reduced (see the illustration below). This allows the trawl to catch nephrops and some flatfish, while other fish escape by going up in the water. According to the fisher interviews this is not used yet. The argument is that the traditional trawl only operates with a 50 cm opening from the bottom, which already allows the fish to escape.

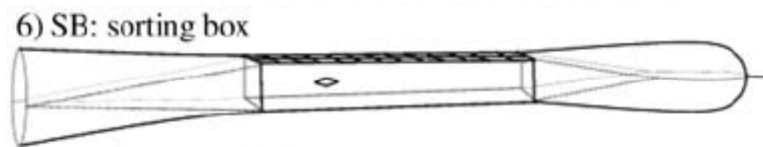
Figure 4: Topless trawl: conventional trawl compared to topless trawl.



Source: Madsen and Valentinsson 2010

Apparently, the mostly used selective trawl is the SELTRA 300 trawl. A six meter long four panel section is put in the trawl before the cod-end. The top panel includes a three meter long escape window with 300 mm square mesh. There is a controversy over the interpretation of the mesh size. Of unclear reasons the present interpretation in the regulation is 300 mm on each side, whereas the fishers interpret this as 300 mm in the diagonal open or closed (in this case the diagonal is 420 mm or 600 mm respective) (fisher interview).

Figure 5: SELTRA trawl with sorting box.



Source: Madsen and Valentinsson 2010

Fishers initiated failed attempts to establish alternative regulation

Traditionally the fishers in the area have been active in regard to better working conditions. They have been strongly represented in the fishermen's association. The chairman of the Danish Fishermen's Association (DFA) through many years; Bent Rulle is still an active fisher on Læsø, where he is chairman of the local fishermen's association. The present chairman of DFA is the former chairman of Strandby Fishermen's Association, and one of the driving forces in the trial of the effort management scheme in Kattegat mentioned below.

The fishers of Kattegat have also been involved in attempts to develop alternative management systems. In the last six years at least two fishers have initiated attempts to establish alternative management schemes, but have failed.

Effort management scheme in Kattegat

The most important attempt was the attempt to establish a trial of effort management scheme in Kattegat. This was a reaction on the cod recovery plan of 2004/2005 and the reduction of fishing opportunities. Danish and Swedish fishers around Kattegat proposed to establish a pure effort management of the Kattegat fishery as a trial. The work with the effort management scheme for Kattegat was done within the framework of the North Sea RAC, in the working group for Skagerrak/Kattegat. The work started in 2005; a first proposal was launched in June 2005 and a revised proposal a year later (NSRAC 2006). The proposal was discussed among the fishers of Kattegat and through the NSRAC with the Commission. In June 2007 a meeting between the working group members and the Commission's Head of Unit Fish A (fisheries conservation) Mr Ernesto Penas Lado took place. Two main problems were left: 1) the actual numbers of days-at-sea (kW-days) in the scheme. The fishers required to know the consequences of the trial before accepting to participate and 2) the management of the days-at-sea in regard to the first three months of the year, where the unwanted catch of juvenile cod is registered as much higher than the rest of the year (NSRAC, WG Skagerrak and Kattegat, June 2007). As these questions could not be answered clearly by the Commission the NS RAC drew back the proposal a few months later. This was apparently a reaction which surprised the Commission (Borg 2007), which seemed to be interested in the trial.

Another factor which probably also played a role in the withdrawal of the proposal from the NSRAC was the development of the FKA system mentioned above. The relation between the transferable quotas and the effort scheme was never clear, and some fishers had the fear that they would lose rights to quotas if they participated in the effort trial.

Selective behaviour – local attempt to verify low catch (and discard) of cod in the nephrops fishery.

The local fisher owned processing industry Læsø Fiskeindustri (fish processing industry) attempted to develop documentation for selective fishery for the nephrops fishers. Læsø Fiskeindustri, one of the largest employers on the island of Læsø, processes nephrops mainly from Kattegat. With the 2008 cod recovery plan and counting 2.5 days-at-sea per actual fishing day in February, March and April, the industry could foresee serious lack of raw material three months a year. Therefore they wanted to put up a project which should document/make it probable that the fishers did not discard cod, and therefore could get additional days-at-sea. The project idea generated by fishers around Læsø Fiskeindustri consisted of documentation of very low discards based on combining existing registrations and new measures:

- Documentation of catches and landings (showing the cod quota is not fully used)
- Using data from an existing observation programme; data from the fisheries control, data from the discard programme and oversampling in relation to establishing a reference fleet (which includes on board observers)
- Documentation of catch area (VMS data)
- Real-time closures of areas with many cod (juvenile as well as over MLS) based on fishers' reports.
- A code of conduct between the participating vessels, with the Læsø Fiskeindustri as responsible for maintaining the code of conduct

The initiative was supported by local politicians, but not actively by the Fishermen's Association and not at all by the Ministry. Internally in the fishermen's association it could probably be a problem that the initiative only covered part of the Kattegat Nephrops fishers. More important that at the same time the ministry worked on the Danish - Swedish bilateral agreement described above, which overruled the local initiative.

Danish Cod Avoidance Plan for the Kattegat

As the cod spawning biomass remains under the minimum level, the direct consequences of the 2008 cod avoidance plan is a 25 % reduction of the quota and fishing effort (days-at-sea) each year, meaning that the available fishing days would be reduced by 76 % from 2008 to 2013. This would close the Kattegat fishery as such. In order to maintain especially the nephrops and flatfish fishery in the Kattegat, the Danish Ministry therefore developed the Danish Cod Avoidance Plan for the Kattegat after consultation with the Danish Fishermen's Association. The plan summarises initiatives taken from 2008 (described above):

- *Closed areas in the Kattegat*
- *Closed area in the Sound*
- *Use of trawl with a square meshed panel in the Kattegat*
- *Introduction of the use of fishing pools in reducing discards*
- *Obligatory use of selective fishing gear in the Kattegat*

The plan documents how these selective measures deliver a reduction in fishing mortality for cod in accordance with the long-term plan for cod stock (Høegh 2010, Ministry of Food, Agriculture and Fishery 2010). The effort in Kattegat (days-at-sea) therefore will be relative stable to 2013 despite of a continued low level of the cod biomass.

Fisher consideration regarding control and legitimacy

Control

The control consists of occasional control at sea, where the vessel is boarded by control officers, landing control, control based on log books, general administrative control and the registrations from auctions. The nephrops fishery in Kattegat is controlled in relation to the cod fishery. 4 % of all cod landings were controlled at land and 10 % of the volume (Ministry of Food, Agriculture and Fishery 2011c). According to the nephrops fishers the control is only registered when they have cod in the catch. The frequency of control is therefore likely to be higher than 4 % of the landings for the nephrops fishers. In general the paper control from auctions and processing industries has increased the last year, which means that landing of larger volumes of unregistered catches for further processing is very difficult and rare. Catch composition control is under development in Denmark, but still only used in relation to cod fishery.

The last year a remarkable case of illegal fishery in the closed area in Kattegat has been revealed. Activists from Greenpeace had illegally placed a hidden GPS at several vessels from the harbour of Gilleleje. The GPS tracking over more than six months showed several illegal entrances in the closed area north of Gilleleje for more than five vessels. The GPS tracking were delivered to the police and used in a trial where so far three fishers have been given fees and confiscation of value of landings. The case has been condemned by the Danish Fishermen's Association. In this particular case one of the interviewed and convicted fishers regrets the illegal fishing; he explains that it developed little by little in the fishing community and was felt legalised especially by two factors: a) the area is only closed to Danish and Swedish fishers. The few German fishers with quotas in Kattegat can– and do – fish fully legally in the area and b) the closure is due to cod recovery, but except for first quarter of the year, there is almost no cod in the area which is the traditionally local and good fishing area for nephrops. The lack of cod was also shown in the landing registrations from the trips.

It should be noted that the fishers wanted the Greenpeace activist convicted for illegal entrance at private area (the vessels). In February 2012 the activist was acquitted in the first instance of law. The illegal entrance to a private area was less important than the possibility to uncover the fishers' illegal activities. This has been appealed to a higher instance.

There are no data on violation of fisheries regulation specifically for the group. In relation to discards (or lack of discards) there are rumours of illegal landing of undersized nephrops for the local and tourist market. There are some examples of the fisheries control catching fishers in selling undersized nephrops from the vessel, but no evidence of organised market for undersized nephrops.

In general, the fishers claim to have good relations with the control officers, though there are stories of strict and rigid interpretation of e.g. the measuring of mesh sizes in relation to the at sea control. Even in relation to the incidence of illegal fisheries and the trial the fisheries control is not blamed for the process.

Legitimacy of the decision rules and measurements in general

In general the fishers signal acceptance of a system of regulation and control; none of the interviewees talked about “the good old days” of no regulation. In discussion of specific themes the fishers mix and interpret their own daily experiences with biological arguments (discuss interaction between species, influence of other factors like water temperature, pollution and chemicals from land, refer to scientific descriptions of fish and fish behaviour etc.). Many of the interviewees have periodically or over longer periods participated in scientific tests of gear, monitoring of discards or specific stock abundance etc. They have experiences in interaction with biologists and other scientists.

Despite of this, the fishers have a massive critique of specific quota assessments and technical measures. This again leads to stated unwillingness to continue the cooperation with biologists and “the system”.

- Some fishers have participated in e.g. test fisheries for assessment of sole over several years. Still the quota was reduced by 25 % “due to lack of data”.
- The registration of discard data lacks several years behind. It does not reflect the present situation as regulations, use of gear and stock composition has changed.
- Based on scientific data especially the fishers from Gilleleje in the southern part of Kattegat argue that the place and time for closing fishing areas do not reflect the appearance of cod which it claims to protect. They feel they are victims in a political process as their arguments are not heard.
- The regulations and technical measures for Kattegat have changed very rapidly in the last years. The fishers are disappointed over lack of time to implement a change, before new restrictive changed rules are introduced. Why not see if the new gear etc. functions?

The conclusion on this differs between the ordinary fishers and the representatives closer to the Danish Fishermen’s Association. The general impression of the reaction from the fishermen is that they seem to think that they could have a kind of agreement with “the system” to have a pause for new rules to implement and evaluate the old ones. But as this is not the case, they seem to have lost trust in the system and tend to conclude that the regulation initiatives are mainly politically generated rather than based on real problems (otherwise former initiatives would have been evaluated), and that new regulations are added to the old ones with new layers of regulations and control systems.

Many of the fishers tend to react, as one fisher: “everything will be used against us, the fishers” -- therefore there is a high level of scepticism even toward reasonable new regulation elements.

This approach is clearly reflected among the chairs of the local fishermen’s associations. Still they explain that the fishers have to take part in the institutions and cooperation that exist.

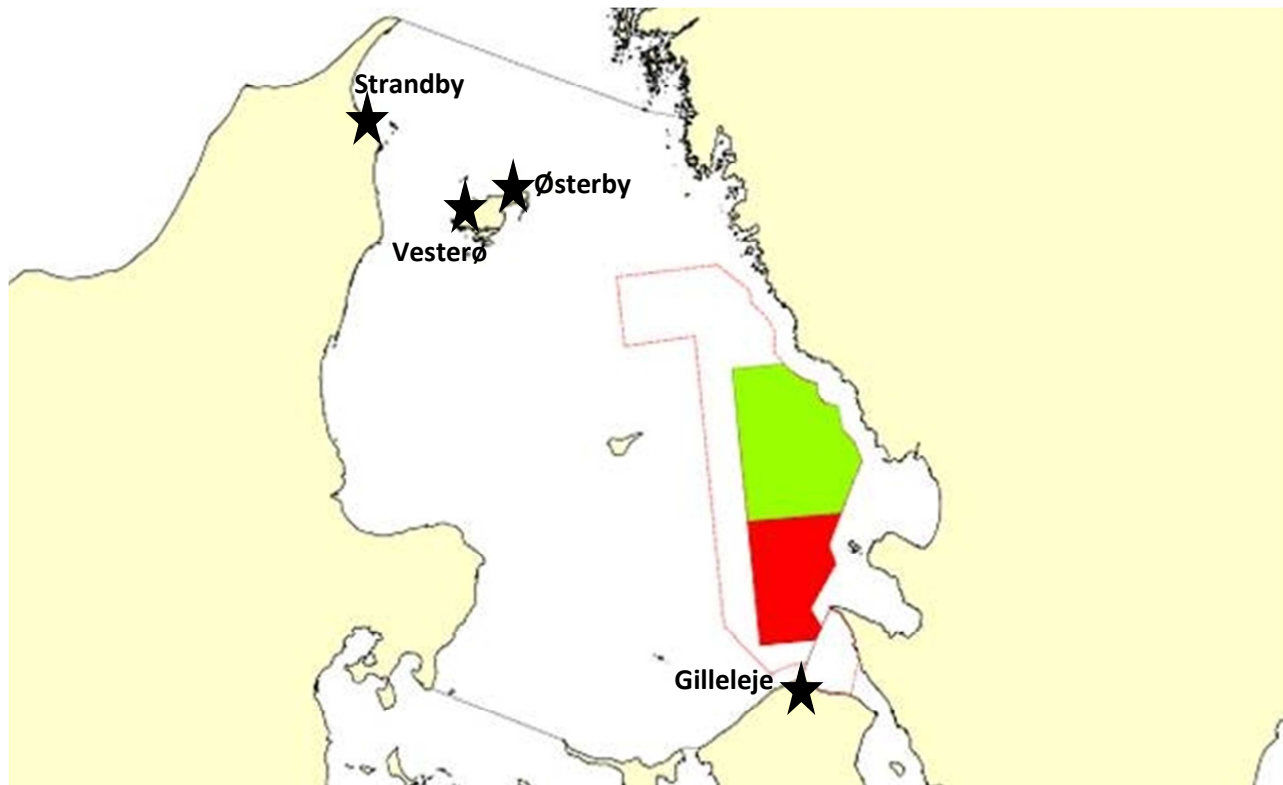
Community

The social structures which influence the discards pattern can be organised in communities at various levels. The most important community, which has been partly invisible during the interviews, is the identity of being a nephrops fisher. In all ports the fishers explained that ten years ago they were mainly fishing cod, with nephrops as a supplementary catch. Today cod is the not the target species, not even seen in all hauls. Most fishers do not catch their entire yearly quota and explain that the cod is so dispersed that they newer go on targeted cod fishery despite of quota left and good prices at the auction.

This is why the description is organised in themes with specific comments if other communities are more dominant in regard to specific identities, norms etc.

Descriptions of the ports/regions as communities

The interviewed fishers are fishing from three (four) ports as communities.



Source: Ministry of food, Agriculture and Fishery 2008, own indication of ports.

Læsø is a small island of 118 square kilometres placed in the northern part of Kattegat. It is the smallest municipality in Denmark. Today Læsø has 1,949 inhabitants, which is a decline from 3,500 in the 1950-ties. For a long time, fisheries have been the dominant profession, but tourism related and public occupations are more important today. Læsø has had a strong tradition of fisheries from the two distinct ports located in the two ends of the Island; Vesterø and Østerby, both with their own branch of the fishermen's association. They merged only a few years ago. The last years there have been a steep decrease in number of vessels and active fishers. Today there are approx. 25 active fishing vessels on Læsø with an expectation of a further decrease in the coming years partly due to very low recruitment of young fishers. This has created a negative view on the future among the fishers. The fishery is highly focused on nephrops delivered to the local fisher-owned Læsø Fiskeindustri. This processing industry has grown relative strong with a processing plant also in Frederikshavn (Jutland) and in Scotland.

Strandby is a local community of 2,400 inhabitants. Strandby is part of the Frederikshavn municipality in the eastern part of Northern Jutland. There are 20 active vessels in the port – previously up to 90 local vessels. The port offers most necessary services as auction, trawl maker, ice, electricians etc. There is also a minor number of fish processing industries in the port.

Gilleleje is a local community of 6,500 inhabitants. Gilleleje is a part of the Helsingør municipality in the northern part of Zealand. The town of Gilleleje has grown around the port. Gilleleje has faced a decrease in the number of vessels. Today there are approx. 15 active vessels left in the port, with an expectation of a further reduction in the coming years. The port has most of the necessary facilities as auction, collection centrals and local craftsmen.

Norms regarding discards

The interviews with fishers have revealed differences in the understandings of discards and what the fishers see as the problem of discards.

There are different opinions among the fishers about what discarded fraction should be discussed or not. Generally the fishers do not see discards of non-commercial species as a problem to be discussed, although they think and fear that the public and political definition will include these parts.

Most of the interviewed fishers see a relevance of discussing discards for commercial species (over and under MLS), whereas a few claim that only the discards of commercial species over MLS (high grading) is to be discussed.

These different views should be seen in the light of how the fisher understands the economic and ecological consequences of fisheries and discards.

Thinking in ecological systems

In general the interviewed fishers expressed an experience-based thinking and understanding of the complex interaction between species and other natural conditions for the fisheries. In a practical way they claimed that the discarded material is not lost, but recycled. Their experiences at the nephrops banks (where they mainly fish) are that all discarded invertebrates, fish and nephrops disappears very fast. The discards will not appear in the trawl all though they return in the same track shortly after. They conclude that most of the discarded nephrops survive and hide after being discarded and/or the remaining nephrops at the sea bottom eat the dead organic material. The interpretation differs between the ports; In one port the fishers believed in a high rate of survival of the discarded nephrops and some fish species, in others they were open to this opportunity as well as the opportunity of the discards to be mainly dead and eaten by others. All reported that only crabs and conchs can be caught dead in following hauls. Many fishers referred to an experience of areas which were left for some time grow wild in plants and therefor turned to be bad fishing areas. A few combined these experiences in agricultural terms of maintain the good bottom for the nephrops by continual trawling and feeding the nephrops with discarded material.

The fisheries regulation in Kattegat is mainly driven by the recovery plans of the cod stock. In this relation the fishers have several theories explaining why the cod remains at a very low level, though they catch very few cod (as indicated by landing statistics). Some of the interviewed points at external factors from land (pollution from land activities: agriculture or industry, heating of the sea from cooling etc.) or at large scale changes of sea temperature etc. as explanations. Stories are told regarding water turning brown of sediments in the melting water from the Swedish rivers in the late spring scaring the fish from the areas 12-15 miles from the coast, or (for the gill-netters near the Swedish coast) acid turning the catch white after heavy rain.

Quite a few though claimed that an uneven fisheries pressure disturbs the balances. As an example the reduction of fisheries for industrial purposes after whiting, small dab and greater weever have led to a growing abundance of these species. The fishers think that they compete with the cod – either as competitors on the feed or they breed on cod larvae's.

Most of the interviewees therefore meant that closing the fishery for industrial purposes have changed the balances of the ecosystem and thereby have had consequences for other species and fisheries. Also in this light, the possible catch and discards of the species without commercial interest are not a problem –it rather helps maintaining a balance in the ecosystem.

Economic approach to discards

All fishers expressed that they need not to discard marketable fish due to lack of quotas. Within an economic approach discards of non-commercial species and some low paid species were regarded as an acceptable and good economy. It was regarded as a waste of energy and financial means to land non-commercial species and organisms. Some fishers stressed the practical problems in handling the volumes of “useless” material. Other than the cost in money and work in some cases were too high compared to market prices.

Political approach to discards

In the biological and economic approach the fishers seem to regard discards only as a small problem. Seen from the fishers' perspectives discards are rather a political problem.

The fishers recognizes the cod is under pressure (it is obvious from their own experiences). The attitude is “they claim cod is under pressure and should be protected – so we better take care and avoid the cod” (fisher from Strandby). Most of the interviewees felt that the public in general and the political audience do not understand the situation in the fisheries, and that discards should be seen as a natural and unavoidable waste in fisheries, although it should be reduced if possible. In this regard several interviewees compared the discards “waste” in fisheries to agriculture, where low prices at the markets could lead to slaughtering of calves and milk poured down the drain. At the same time all interviewees understood that the public opinion “is not blowing in our direction (regarding discards and discards ban)”. In political terms discards are a problem and they have to deal with reduction of discards, except from their practical views on discards.

During the interviews there were no examples of active social enforcement of the norms regarding discard – neither in pro discard (laughing of or teasing someone landing many small fish) or contra discard (troubling someone with only large individual indicating a high level of high grading). Two interviewees though referred in a negative tone to larger vessels which went for at fishing ground in Skagerrak with high abundance of nephrops, but high level of undersized. Despite from this, the general acceptance of the view on discard (various aspects) could be seen as the general social norms on discards.

The fishers' active steps to reduce or avoid discards

First of all the, over time fishers have changed the trawl according to the changing regulations, changes in mesh sizes, the cod-end, use of panels and windows etc. Some of these measures are more restrictive in the Kattegat area than in Skagerrak, but several fishers claimed that they also used the new more selective

gear in Skagerrak, mainly to avoid investments in different types of gear and repeatedly change of gear when they change fishing areas.

Even within Kattegat the strict interpretation of the rules by the fisheries control forces the fishers to use mesh sizes a little larger than the minimal allowed. During use the mesh sizes tend to shrink. Therefore 95 mm mesh size is preferable to 90 mm mesh size in the cod-end in the recent trawls.

The fishers try to avoid the areas with a higher concentration of cod, even though they hold unused quota for cod. Different reasons are mentioned. At one hand a sense of responsibility for the stock and public pressure: "They say the cod is not in good shape – so we better avoid them". At the other hand a more practical reason; despite a higher concentration of cod in these areas, the outcome from targeting nephrops in other areas is still higher. The cod is simply not as financially interesting a target as nephrops in other areas.

Knowledge about fishing places etc. is exchanged between the fishers in different social groups. To some degree the information exchange is based on ports, but within and across the ports information is also exchanged in other networks. The overall picture from the interviews is that in general information is spread via the telephone in a one-to-one communication, but very quickly spread in the whole group due to intense communication by telephone and communication in the port. There seems to be openness about use of gear as well as problems and considerations about best use of the gear. Information about fishing grounds is also exchanged, though apparently more in closer relations, though also this type of information is generally widespread in a short amount of time. It was mentioned as an exception from the openness that a fisher could "work up" a fishing ground (by trawling the same areas several times in order to remove any stones). In this situation there is an acceptance of the fisher's attempt to keep this place as his own secret. The culture of who to share information with seems to differ between the ports. All agreed that information would diffuse to all fishers in the port during short time. In some ports it was claimed that all interested were informed about good fishing grounds etc. as the open radio was used as media for information sharing. In other ports the information was shared only with some of the local fishers via mobile phones, while the rest of the fishers in the port would only learn about this later on when the information was spread in an indirect way (Cay gossip etc.).

Finally the fishers presented various ideas of improvement of the trawl and other devices which could change the catch composition. But it was also concluded that in the present situation with detailed micromanagement most of these changes could not be tested without cooperation with research (here DTU Aqua). The test results from the research institutions are necessary for getting the changes accepted by management and control authorities.

Identity: The fishers are marginalised in society and stigmatised as cheaters

The fishers feel stigmatised as cheaters, as a fisher expressed it: "Everybody thinks we are cheating". In this light they are very reluctant to most new initiatives as they feel they will be used against them.

In general the fishers feel they have "done what we were told to" over time, in regard to change of trawl types, closed areas, investments in quotas etc. They feel that the authorities just augment the claims and the stream of new regulations which is forced on them.

There seems to be an expectation of being able to make agreements with the management system. This means; if the fishers would accept a certain new restrictive regulation, they would be able to be free of further changes for a period of time. During the interviews the fishers express disappointment and feel the level of restrictions are changed all the time – whenever they try to adjust to one regulation (e.g. a new type of gear) other regulations are being added immediately.

The disappointment regarding “agreements” with the management system and a feeling of being stigmatised as cheaters *could* result in a reaction of systematic non-compliance. Except for the fishing in closed areas (as described above) none such reactions were registered. On the contrary several fishers felt stressed of the feeling of never being able to fulfil all regulations. The dilemma of not wanting to be illegal and cheating and at the same time not being able to fulfil all requirements might be the reason why there are no examples of social control against non-compliance. During the interviews a few examples of enforcement of informal social control were given. But none was related to discards. Some of the interviewed can tell that they are told (at a rumour level) that somebody is cheating (fishing with too small mesh size, selling fish under MLS etc.). But in the stories these things has never been related to social control enforcement. It seems not to be approved, but it is accepted.

The identity as fisher was not an explicit theme during the interview. Most of the interviewed had been fishers all their life and came from fishing families – with references to fathers, uncles etc. as fishers. But only one of the fishers had sons in the fishery. Some claimed they had warned their sons against starting fishing; one even claimed he had refused guaranteeing his son’s loan to buy a vessel. The conditions in the fisheries; changing regulations, uncertainty regarding the future conditions, the feeling of being illegal were used as arguments against a future in the fisheries for their sons – not the current financial situation and in general not the working conditions.

Market

The market is expected to be an important driver for discarding certain types of the catch for which there are no market at all or very low prices.

Value of landings from Kattegat

The statistics of all landings in Denmark from Kattegat (3AS) show registered landing of 51 species in a total value of 20 mill € in 2001. Of the 51 species only 8 has a total landing value over 100,000 €/year.

Nephrops is by far the dominant commercial species, counting for 67 % of the landing values of consumer fish from Kattegat. Sole is the second most important. Cod only values 1 % of the total landing value as shown Table 6 below.

Table 6: Total landings in Danish ports from Kattegat 2010 - Danish and foreign vessels. Value, volume and price pr. kilo (source: www.fvm.dk).

Species	value (1000 €)	% of total value	volume (t)	Price pr. kilo (€/kg)
Nephrops	€ 13,549,7	66.9	1,774	€ 7.64
Sole	€ 3,203,9	15.8	301	€ 10.64
Herring	€ 1,280,6	6.3	3,349	€ 0.38
Lumpfish	€ 406,3	2.0	71	€ 5.72
Brill	€ 332,8	1.6	68	€ 4.89
Plaice	€ 303,4	1.5	289	€ 1.05
Turbot	€ 224,0	1.1	33	€ 6.79
Cod	€ 208,7	1.0	113	€ 1.85
all other species	€ 732,0	3.6	712	€ 1.03
total landing	€ 20,241,2		6,710	€ 3.02

Market related discard from Kattegat

Based on the WP 4 Working Paper and the result from the WP 3 analysis (ref.) one could expect market related discards of species with no market or with very low market price. There could be at least two reasons for discarding already caught marketable, but low priced fish. First the possibility of high grading, that the available quota should be used on larger and better prices individuals. Second that the fishers' interpretation of cost of bringing the catch at the auction as higher than the possible income from sale.

In the present situation in the Danish nephrops fishery, the high grading seems not to be relevant, as seen above in relation to quota related discards. But there are examples of discards of species and individuals with no or very low market value.

Considerations regarding Minimum Landing Sizes

Generally Minimum Landing Sizes, MLS is regarded as a conservation measure. But it is clearly connected to which sizes are marketable. The fishers are obviously annoyed with regulations which force the fishers to discard marketable fish – being 0-quota at a species or MLS over marketable size. In an interview an example of the latter was told; the rising of the MLS for a certain species resulted in discarding of fish previously over MLS and marketable, now under MLS. At the other hand there is a market for nephrops below the Danish MLS (as the MLS is lower in other regions). Still the fishers fear that a lower MLS probably would destroy the market also for the larger size nephrops (over the present MLS). The fishers therefore assess the MLS against the market possibilities.

Direct sales costs for low paid species

The interviews revealed that some species which are paid with very low or varying (and therefore unpredictable) prices tend to get discarded of economic reasons. The flounder is an example of this. In periods they are purchased at very low prices at the auctions.

Table 7: Landing prices for flounder (not cleaned) at the auction in Strandby, January 10 to 17 2012.

Date	Quality	Average price (€)	Volume (kg)
Jan. 10	2	0.135	111
	9	0.485	729
Jan. 11	2	0.323	125
	9	0.390	366
Jan. 12	9	0.370	237
Jan. 16	9	0.420	137
Jan. 17	2	0.162	178
	9	0.377	92

Source: Fiskeauktion.dk

The cost of landing fish is (based on prices in the port of Gilleleje)

- Rent of the box (of 30 kg fish): € 0.88 (DKK 6.50) (to be paid when the box is landed)
- Ice per box: € 0.88 (DKK 6.50)
- Landing cost to the port: 3 %
- Sales cost to the auction: 13%

Based on the lowest price in the list above; 111 kg flounder quality 2 in four boxes on 10 January, the sales income is € 14.93, while the cost would be € 4.14, with € 10.79 (less than 0.10 €/kg) in income after sales costs¹.

Interpretation of cost in relation to discards

Not only the market prices, but also the cost (direct or indirect) influences the fishers' interpretation of net income from handling the specific catch. Various factors seem to influence this:

- Expected price at the market and income from sale of each species
- Direct costs related to landing as shown above.
 - o The landing costs are partly related to the number of boxes. New regulations on traceability might lead to use of more boxes than previously. For catches less of 30 kg (a full box) regulation defines which species, sizes and qualities can be mixed in the same box. In some cases one individual of a given species and size will require a separate box.
- Indirect costs
 - o The practical difficulty of handling the box; many half empty boxes can be a problem to handle depending on the storage room and number of crew aboard.
 - o Quite a few of the interviewed fishers were in their late 40-ties or 50-ties and regarded themselves as physically worn out. The extra effort and difficulty in lifting and handling boxes seem to be valued as a higher priced "cost", when assessing whether it is worth your while to keep or discard the fish. This factor also depends on the technology level on the vessel, to which degree the handling of boxes are manual or automatized.

¹ Rent of four boxes: € 3.50, Ice: € 3.50. Cost to the port for landing: 3 % of € 14.93 = 0.45. Cost to the auction for sale: 13 % of € 14.939 = 1,94. Total cost: € 4.14.

As the general paying method for crew members is catch value shares, the time spent for sorting the catch (and discards) do not influence the direct cost of handling and landing the box. But there is an indirect cost related to this; Time and effort used for sorting and eventually handling catches are considered as an indirect cost to be taken into consideration, especially for the elder or the worn out fishers. This interpretation of indirect costs of using time and effort on fish handling can lead to a higher or a lower discard behaviour.

In some instances the effort of handling can be seen as too (indirect) costly for some low paid species. Given the (worst) example above the fisher may consider if it is worth the effort of handling, packaging and landing 110 kg flounder for 10 € ? – as expressed: “The income has to be decent. I am not doing this for fun”.

While the indirect costs in handling the catch can lead to the discards of fish which could have given some income at the auction the valuation of sorting effort can also be an incentive for avoiding areas with a high level of unwanted catch to discard. A fisher, fishing alone, normally with relative short hauls mentioned that a huge sorting effort could delay the fishing. He had to finish sorting before the next haul was taken aboard. In certain situation this argues for to avoiding the areas with a potentially high level of unwanted catch and discards. He and other fishers therefore preferred, if possible, to fish in areas known for eventually fewer, but larger nephrops. Likewise areas with many small dabs or greater weevers were avoided to reduce the sorting work.

Technological investments

In general the vessels are relative old. In the last years the larger investments seem to have focused on buying up old vessels with quotas. In that case the best vessel (often the newest) is used for fishery, while the other is sold or scrapped. Two of the quota pools had collectively bought quotas (with vessels), and some fishers had bought vessels and quota at private basis. The scope of quota buy up in Kattegat is however not clear in this relation. Very few of the interviewed have invested in quotas as they are able to rent supplementary quotas if their individual quota composition does not fit the actual catches. Everybody had invested in new trawl in order to follow the changing rules regarding mesh size, panels and windows etc. In relation to discards the long-term investments in vessels is directed towards augmenting the available quota, while, to a large extent, the short-term investments (in gear) have been directed towards reduction of unwanted catch of cod, and thereby reduction of at least the demersal fish by catch and discards.

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Appendix

Source: Imares 2010, Table 1. Summary of the mean numbers (Nb) and weights (Wt, in kg) of species discarded (top, D) and landed (bottom, L) per hour per trip for each métier (active gears). Species of commercial interest/target species are highlighted in grey. *indicates top ten ranking numbers. Blank cells: species were either not caught and/or not recorded. NA = No data were available.

Kattegat (IIIa, IIIb)

OTB: bottom otter trawl, TBB: beam trawlers, SDN: anchored seines. DEF: demersal fish, CRU: crustaceans (from: COMMISSION DECISION of 6 November 2008 adopting a multiannual Community programme pursuant to Council Regulation (EC) No 199/2008 establishing a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy (2008/949/EC) (948_2008.pdf).

Species	Metier	OTB_CRU	OTB_DEF	TBB_DEF	SDN_DEF
	Country	DNK	DNK	DNK	DNK
	ICES sub-area	IIIan	IIIan	IIIan	IIIan
	Average trip duration	2.78	3.55	7.54	2.35
	Metier	Mean	Mean	Mean	Mean
Eutrigla gurnardus – gray gurnard	D (Nb)	7.4	9.9	3.9	4.5
	D (Wt)	0.6	1.1	0.6	0.7
	L (Nb)	0.8	1.2		1.6
	L (Wt)	0.1	0.2		0.3
Gadus morhua – cod	D (Nb)	29.5	36.8	7.9	48.5
	D (Wt)	8.8	16.2	2.5	19.8
	L (Nb)	4.2	16.5	2.7	25.9
	L (Wt)	8.0	30.8	10.5	36.3
Glyptocephalus cynoglossus –torbay sole	D (Nb)	19.9	20.8	0.6	2.0
	D (Wt)	1.4	2.3	0.2	0.2
	L (Nb)	12.6	25.4	0.4	40.1
	L (Wt)	3.9	7.5	0.9	12.0
Hippoglossoides platessoides – American plaice	D (Nb)	97.4	19.8	0.8	14.3
	D (Wt)	4.7	1.4	0.0	2.1
	L (Nb)	0.1			
	L (Wt)	0.0			
Limanda limanda – dab	D (Nb)	54.9	61.2	88.8	67.8
	D (Wt)	3.4	6.9	6.5	9.1
	L (Nb)	1.4	18.0	45.1	36.5
	L (Wt)	0.4	4.7	9.3	8.1
Lophius piscatorius –monkfish	D (Nb)	0.9	0.7	0.6	0.9
	D (Wt)	0.2	0.2	0.2	0.2
	L (Nb)	0.6	1.7	0.5	0.5
	L (Wt)	2.3	5.9	2.9	1.4
Melanogrammus aeglefinus –haddock	D (Nb)	27.2	30.0	1.1	15.2
	D (Wt)	5.1	6.0	0.1	3.6
	L (Nb)	7.0	42.8	0.6	42.8

	L (Wt)	4.8	27.5	1.0	35.7
Merlangius merlangus – whiting	D (Nb)	30.7	9.4	0.6	4.8
	D (Wt)	4.0	1.5	0.0	0.4
	L (Nb)	2.6	2.1		0.8
	L (Wt)	0.8	1.0		0.3
Merluccius merluccius – hake	D (Nb)	6.6	5.7		4.3
	D (Wt)	1.9	1.6		1.5
	L (Nb)	2.4	2.0	0.4	2.5
	L (Wt)	2.4	2.4	0.9	2.7
Microstomus kitt – lemon sole	D (Nb)	5.7	8.1	0.7	3.1
	D (Wt)	0.7	1.1	0.1	0.4
	L (Nb)	1.5	10.0	4.5	11.1
	L (Wt)	0.4	3.6	2.5	3.0
Nephrops norvegicus – nephrops	D (Nb)	873.0	106.3		0.4
	D (Wt)	20.9	2.7		0.0
	L (Nb)	288.7	53.6		0.3
	L (Wt)	16.4	4.9		0.0
Platichthys flesus – flounder	D (Nb)	1.7	2.2	0.8	11.7
	D (Wt)	0.2	0.8	0.3	4.8
	L (Nb)	0.1	1.5		7.3
	L (Wt)	0.0	1.0		2.3
Pleuronectes platessa – plaice	D (Nb)	21.6	77.8	190.5	314.2
	D (Wt)	3.1	11.7	26.7	46.3
	L (Nb)	7.1	58.6	485.0	262.2
	L (Wt)	2.5	17.7	161.6	73.6
Pollachius pollachius – pollock	D (Nb)		0.4		
	D (Wt)		0.4		
	L (Nb)	0.6	0.7		0.9
	L (Wt)	1.2	1.9	4.0	2.0
Pollachius virens — coalfish	D (Nb)	9.7	11.4	0.3	3.4
	D (Wt)	7.7	7.1	0.1	2.7
	L (Nb)	21.9	34.7	0.4	9.8
	L (Wt)	28.2	56.0	1.1	25.5
Psetta maxima – turbot -	D (Nb)	0.3	1.7	0.5	1.5
	D (Wt)	0.1	0.7	0.3	0.4
	L (Nb)	0.2	1.6	3.3	0.5
	L (Wt)	0.4	2.1	5.0	1.0
Solea solea – sole	D (Nb)	2.7	1.5	0.7	
	D (Wt)	0.3	0.1	0.0	
	L (Nb)	0.9	6.7	5.9	0.8
	L (Wt)	0.3	2.3	2.4	0.3

Appendix 2: The Greek case study: The Greek Otter trawl fishery

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Case: The Greek Otter Trawl Fishery

Introduction and summary

The case description is structured around the list of factors, which might function as drivers for the discards and selective behaviours. As with the Kattegat Case Study (CS) these are somewhat “artificially” split in natural conditions/state/market and community drivers for high discarding and low discarding behaviour but discussed in more than one place. Table 2 summarizes findings and factors relevant to the Greek CS.

The data for the Greek case study originate from desk research, to some degree conclusion from previous work packages of the Badminton project and 16 personal interviews with fishers from 8 ports, 3 ports in the Ionian Sea (7 interviews) and 5 ports in the Aegean Sea (9 interviews) (Figure 1).



Figure 1: The ports where interviews were conducted.

The interviewees are based on major ports for trawl vessels in the Ionian and Aegean Seas. They are either skippers or owners of trawl vessels who however take part in fishing activities and have a very good idea of practices related to mixed demersal trawl fisheries exerted in the area. Several of the fishers participate occasionally in research related fishery (test of trawl, selectivity experiments). Most interviews took place in facilities in the port. The interviews had duration of 1-2 hours. In most cases (depending of agreement with the interview person) the summary of the interview was sent for comment/approval to the interviewee.

Summary: the most important factors

In the scheme below is summarised the findings from the case study, distributed on the natural conditions and the three types of institutions (state, community, market) and how the factors contributes as a driver for a behaviour of high discard level or driver for selective or low-discard behaviour.

Table 1: Summary of factors driving toward a higher or lower discard level

	Drivers for high discarding behaviour	Drivers for selective/low(er) discarding behaviour
Natural conditions	<ul style="list-style-type: none"> *Mixed demersal fishery – unavoidable bycatch * Nursery grounds-high bycatch/discards of young fish 	<p>Using selective gear: fishers are interested if it would reduce sorting times (and cost) by providing “cleaner” catches and retain /or increase profits. However, they feel that most escapees are damaged and die anyways.</p> <p>Adopting spatio-temporal closures: provided there is strong scientific evidence, regular review of the situation, and effort displacement in other areas</p>
State	<ul style="list-style-type: none"> *MLS regulation and landing ban of undersized fish *Landing and administrative control 	<ul style="list-style-type: none"> * Relatively low compliance results in low discarding. *Compulsory use of selective gear, but enforcement is rather weak.
Market	<ul style="list-style-type: none"> *Low prices on certain species (high grading) 	<ul style="list-style-type: none"> * Lately the financial crisis resulted in less high grading and even low demand species are now more attractive to consumers. * Local “black” markets for undersized fish (as seen in fish taverns and documented in questionnaires)
Community	<ul style="list-style-type: none"> *View on discard - some of it is OK in the Mediterranean oligotrophic ecosystem since they’re feeding benthos, fish and seabirds. They do not perceive it as an important problem. 	

Natural conditions for the Greek Otter trawl fishery:

The Aegean Sea covers about 214,000 square kilometres in area. The sea's maximum depth is 3,543 metres, east of Crete. The Ionian Sea is much deeper than the Aegean with narrow continental shelf. The Calypso Deep, the deepest point in the Mediterranean at –5,267 m is located in the Ionian Sea, south-west of Pylos, Peloponnese (Figure 2).

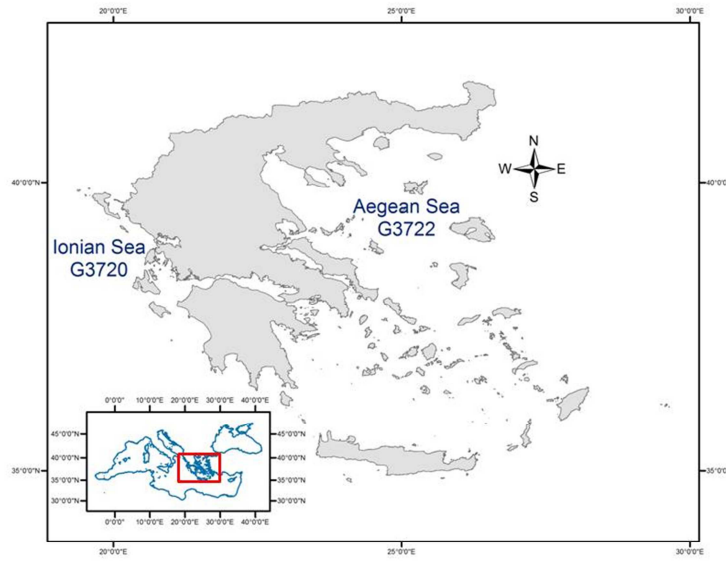


Figure 2: Greek case study

Trawl fishery in Greece, as well as most small scale fisheries in Mediterranean, could be characterised as a multispecies fishery. The most common targeted species consist of *Mullus barbatus*, *Merluccius merluccius*, *Parapenaeus longirostris*. A large proportion of the catch also includes *Mullus surmuletus*, *Loligo vulgaris*, *Illex coindetii*, *Diplopus annularis*, and *Trachurus trachurus*.

The registered discard situation

Figures 3 and 4 show the discards composition in Ionian and Aegean Sea, respectively, based on data collected in 2003-2006, 2008.

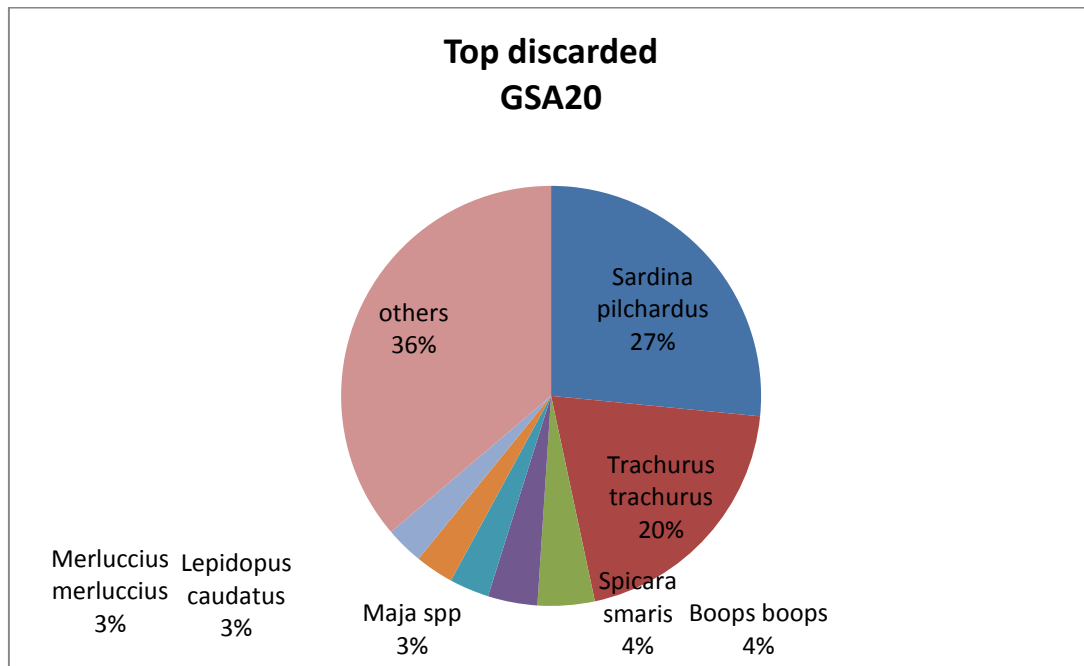


Figure 3: Discarded otter trawl species composition in the Ionian Sea

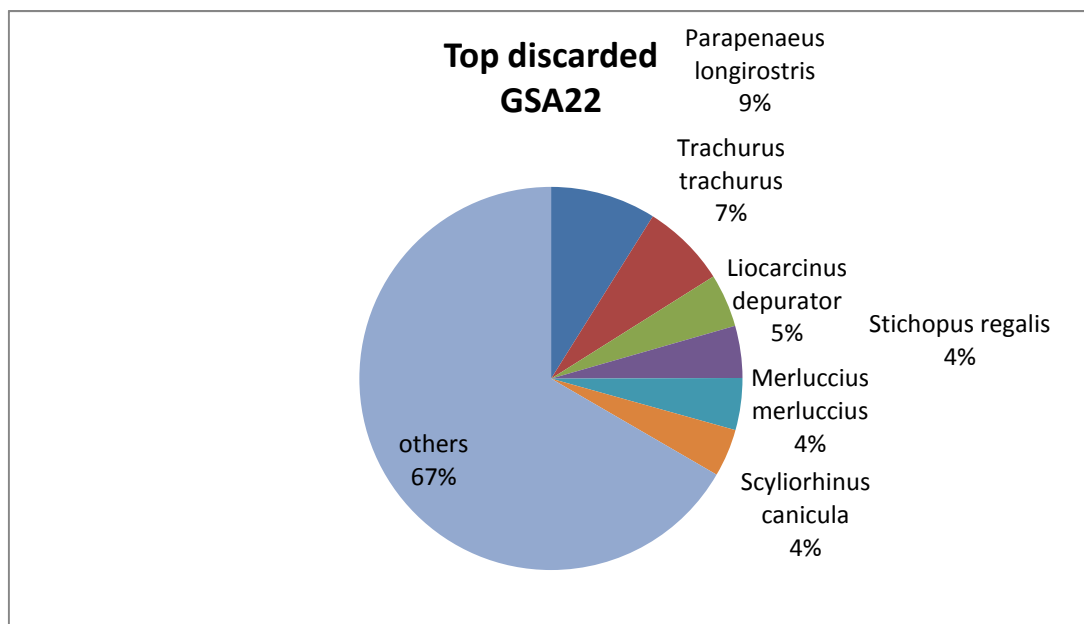


Figure 4: Discarded otter trawl species composition in the Aegean Sea

For the identification of the reasons for discarding discards data were analysed and allocated in four categories based on the length of individuals discarded. The categories as well as the inferred reasons for discarding are presented in Table 2.

Table 2: Categories of discards and the associated reason for discarding (Catchpole 2012)

Category	Characteristics	Inferred reason for discarding
1	Discarded fish below the legal minimum landing size (MLS)	Mismatch between selectivity of the fishing gear and the legal MLS (however, due to low enforcement/compliance certain undersized fish that have a market price are sold).
2	Species with no commercial value/never landed (includes protected species); fish with no associated legal MLS	Mismatch between the selectivity of the fishing gear and the opportunity to sell the fish (no market)
3	Fish with low demand and without a MLS	Inconsistency in marketing opportunities; inconsistencies in sorting the catch; damage to fish
4	Fish with low demand and with a legal MLS discarded at or above the legal MLS	Inconsistency in the marketing opportunities; inconsistencies in sorting the catch; damage to fish

Figures 5 and 6 summarise the reason for discarding for the Ionian and Aegean Sea, respectively. In the Ionian Sea the largest proportion of discards are either over MLS or below the minimum retention length. As a result, the most common inferred reasons for discarding are the mismatch between the selectivity of the fishing gear and the opportunity to sell the fish and the inconsistency in marketing opportunities or damaged fish. *Parapenaeus longirostris*, *Sardina pilchardus*, *Trachurus trachurus*, *Boops boops* and *Engraulis encrasicolus* constitute the largest proportion of the species that are over MLS. Sardine and anchovy are prohibited to be landed by trawlers. *Spicara smaris*, *Citharus linguatula* and *Spicara flexuosa* are mostly contributed to the species that are above the minimum length landed. Since there is no quota regulation in Greece this part of discards is inferred to inconsistency in the marketing opportunities. The discarded species that correspond to mismatch between the selectivity of the fishing gears and the legal MLS are mostly participated by *Merluccius merluccius*, *Trachurus trachurus* and *Parapenaeus longirostris*. Finally, fishes that are totally discarded are non-commercial species such as *Lepidotrigla cavillone*, *Argentina sphyraena*, *Arnoglossus laterna* and *Lepidopus caudatus*.

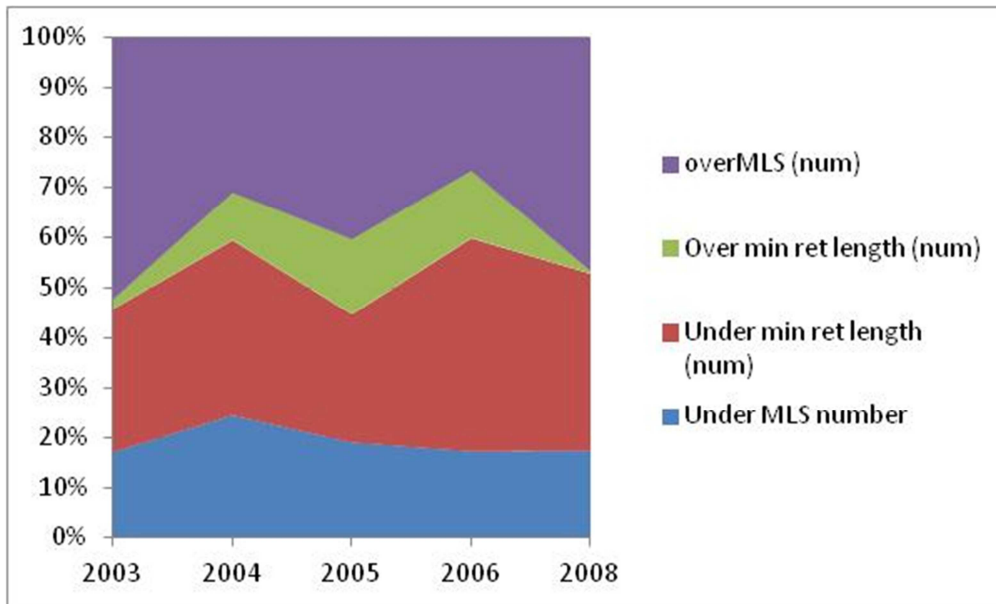


Figure 5: Discards allocation to reasons for discarding based on MLS or on minimum retention length in the Ionian Sea (GSA 3720 OTB_GRC - combined OTB métiers)

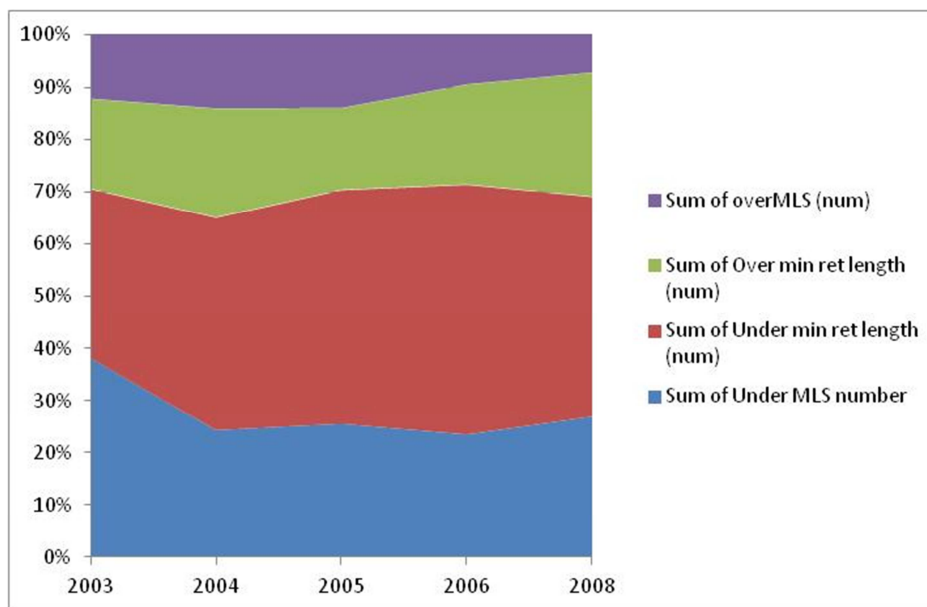


Figure 6: Discards allocation to reasons for discarding based on MLS or on minimum retention length in the Aegean Sea (GSA 3722 Aegean Sea OTB_GRC - combined OTB métiers)

In the Aegean Sea almost 70 % of discards in number of individuals is allocated in the under MLS and the under minimum retention categories. So, the most common inferred reasons for discarding are the mismatch between the selectivity of the fishing gear and the legal MLS or the opportunity to sell the fish. The discards under minimum retention length are mostly participated by non-commercial species such as *Gadiculus argenteus*, *Macroramphosus scolopax* and *Argentina sphyraena*. On the other hand the under MLS category consists of species such as *Parapenaeus longirostris*, *Merluccius merluccius* and *Trachurus trachurus* due to the mismatch between selectivity of the fishing gear and the legal MLS. More than 80 % of the discards belonging to the over MLS category constitute of *Parapenaeus longirostris*, *Trachurus*

trachurus, *Sardina pilchardus* and *Engraulis encrasicolus*. Amongst them sardine and anchovy are prohibited to be landed by trawlers, while the other two species are discarded due to the inconsistency in marketing opportunities or as damaged. Finally, species such as *Illex coindetii*, *Citharus linguatula* and *Spicara smaris* are discarded above the minimum landed length due to inconsistency to marketing opportunities.

The fleet

Trawl fishery in Greece numbered 323 vessels in 2008, with a total Gross Tonnage of 30.793, which corresponded to the 34.97 % of the total GT of Greek fishing fleet and total horse power up to 91880 KW. The proportion of trawl vessels in the total fishing fleet was 1.8 %, however trawl fishery contributed to the 20 % of the total landings. The average crew per vessel was 6.5 and 7.13 for vessels 12-24 m and >24 m respectively in the Aegean Sea and 5.06 for the Ionian Sea (NSSG, 2008).

The highest annual gross income per species per vessel for 2008 was attributed to *Merluccius merluccius* for both Aegean and Ionian Sea. In the Aegean Sea the annual income for the hake per vessel for vessels 12-24 m were 61151€ and 108406€ for vessels >24 m. In the Ionian Sea these values were 87717€ and 139462€, respectively. *Mullus barbatus* has also possessed a large proportion of the annual gross income in both seas. Cephalopods and mostly *Loligo vulgaris* had a large contribution to the total annual gross income in the Ionian Sea.

The annual crew cost per vessel for trawls 12-24 m in the Aegean Sea was 53166€ and for vessels >24 m 72295€. In the Ionian Sea the annual trawl crew cost was 59588€ per vessel. Crew members are paid by salaries with the exception of the Michaniona port where they paid by shares of the landings.



Figure 7: Greek trawlers operating in North Aegean Sea. Source http://notios-voikos.blogspot.com/2011/09/blog-post_4182.html

State: The regulation of the Greek trawl fishery

The EC Regulation 1967/2006 bans bottom-trawl activities within 1.5 NM off the coast and imposes a modification of the cod-end mesh opening to 40 mm square mesh instead of diamond mesh or to 50 mm diamond mesh. The Greek legislation has adapted the EU regulation regarding the mesh size. As concerns the distance of trawling operations from the coast, the national regulation bans bottom-trawl activities in depths less than 50 m or 3 NM, where the 50 m isobath is extended further than 3 NM. Additionally, there is a four month closure (May-September) of trawl fishery in the Greek Seas and several local spatiotemporal closures (**e.g. Figure 7**). Trawl fishery is totally restricted in certain areas e.g. Porto Lagos Gulf, Amvrakikos and Itea Gulf and others. MLS is also applied for most of **the commercial species (Table 3)** and fishers obliged to discard fish under MLS. The compliance of Greek fishermen to the national and EU regulations is generally loose, especially regarding the MLS, resulting by the weakness of the authorities to monitor the numerous fishing vessels in remote fishing grounds and to impose the regulations.

Table 3: Fish MLS according to the Hellenic legislation and the EC Regulation 1967/2006

Scientific name	Common name	Minimum size Hellenic Legislation	Min size 1967/2006
1. Fish			
<i>Anguila anguila</i>	Eel	30 cm	
<i>Boops boops</i>	Bogue	10 cm	
<i>Dicentrarchus labrax</i>	sea bass	23 cm	25 cm
<i>Diplodus annularis</i>	Annular sea bream	15 cm	12 cm
<i>Diplodus puntazzo</i>	sharpsnout sea bream		18 cm
<i>Diplodus sargus</i>	White sea bream	15 cm	23 cm
<i>Diplodus vulgaris</i>	Two-banded sea bream		18 cm
<i>Engraulis engrasicolus</i>	European anchovy	9 cm	9 cm
<i>Epinephelus</i> spp.	Groupers		45 cm
<i>Epinephelus guaza</i>	Grouper	45 cm	
<i>Lophius</i> spp.	Anglerfish	30 cm	
<i>Lithognathus mormyrus</i>	striped sea bream		20 cm
<i>Lichia amia</i>	Leer fish	14 cm	
<i>Merluccius merluccius</i>	Hake	20 cm	20 cm
<i>Mugil cephalus</i>	Common grey mullet	16 cm	
<i>Mullus barbatus</i>	striped mullet	11 cm	11 cm
<i>Mullus surmuletus</i>	Red mullet	11 cm	11 cm
<i>Pagellus acarne</i>	spanish sea bream		17 cm
<i>Pagellus bogaraveo</i>	Red sea bream		33 cm
<i>Pagellus erythrinus</i>	Common pandora	12 cm	15 cm
<i>Pagrus pagrus</i>	Common sea bream	18 cm	18 cm
<i>Polyprion americanus</i>	Wreckfish	45 cm	45 cm
<i>Sardina pilchardus</i>	European sardine		11 cm
<i>Sardinella aurita</i>	Gilt Sardine	10 cm	
<i>Scomber japonicus</i>	Chub mackerel	12 cm	18 cm
<i>Scomber</i> spp.	Mackerel	18 cm	18 cm
<i>Solea vulgaris</i>	Common sole	20 cm	20 cm

<i>Sparus aurata</i>	Gilt-head sea bream	20 cm	20 cm
<i>Thunnus thynnus</i>	Tune fish	70 cm - 6.4kg	
<i>Trachurus spp.</i>	Horse mackerel, scad	12 cm	15 cm
<i>Xiphias gladius</i>	Swordfish	120 cm	

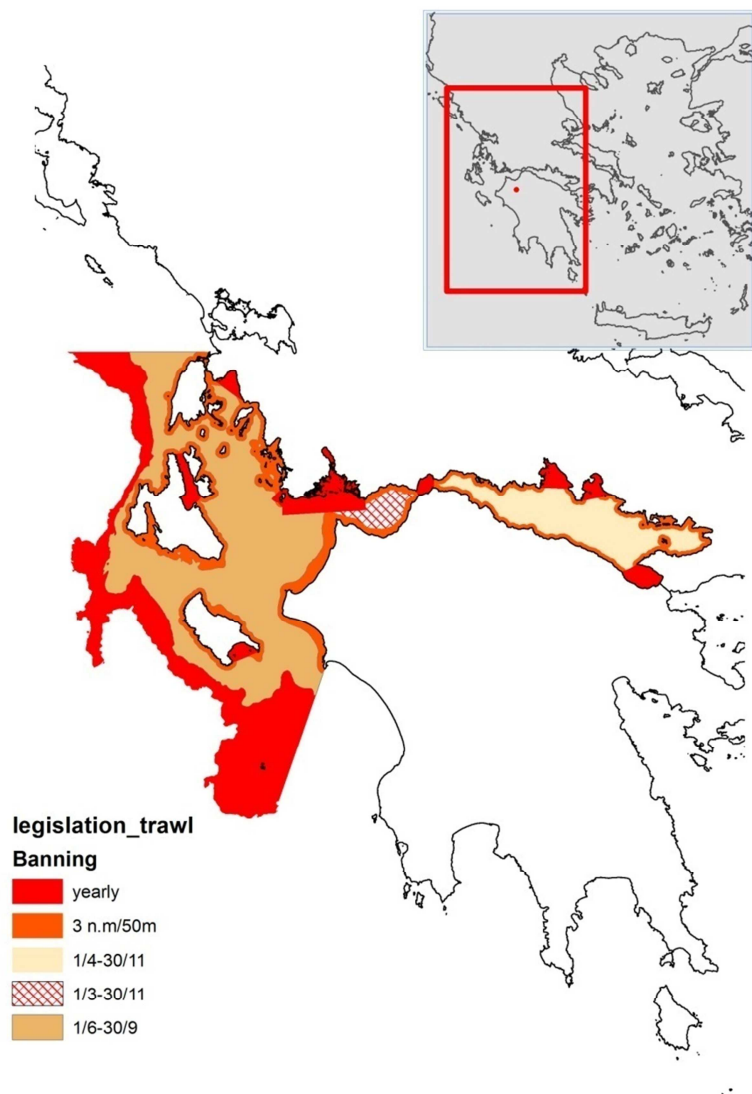


Figure 8: An example of spatiotemporal closures for trawlers in Korinthiakos Gulf, Patraikos Gulf and a part of the Ionian Sea.

Fisher consideration regarding control and legitimacy

Control

The control consists of occasional control at sea, where the vessel is boarded by control officers, landing control, control based on log books, general administrative control and the registrations from auctions. There is no published historical or recent information on frequency of controls, changes in types of controls and publicly accessible information on trends or changes in types of violations or even administrative and

financial penalties imposed (i.e. fines and loss of fishing days). Control in the harbour or at sea is aimed at checking use of correct mesh size, although an unknown number of relevant authorities do not even possess proper mesh gauges (no data on how widespread is this lack or how strict is the control of the mesh size). Control in the harbour and at sea is also aimed at checking catch and deviations from MLS, again this is thought to being rarely enforced, although there are no data to show how/which auction sites have/had stricter controls. There are no official data on frequency or quantities of undersized discards or landings, and indeed very rarely the media will report on these except when NGO's will make the case of showing landings under MLS. Log books are minimalistic compared with logbooks kept in Northern European countries. Checks also include issue of proper tax receipts and waybills (recently also as part of fight against tax evasion).

The main controls are the automated controls via the "blue box" the VMS system, what the fishermen call the "lazy from your office and fuel saving controls" on the spatio-temporal closures. These include a) fishing in the wrong/closed season, which are both enforced by port authorities and respected/non-violated by the fishermen, b) fishing in trawling season in closed bays (no data on frequency of violations) and c) fishing in forbidden zones arising from the EU Regulation 1967/2006 i.e. on Posidonia beds maerl or in less than 1.5 mile distance from the shore independently of depth in addition to less than 1 nm or shallower than 50 m depth whichever comes first (as per national law). The loss of the fishing ground between 1.0 mile and 1.5 miles is what the fishermen consider their biggest loss in recent decades.

In general the fishers claim to have good relations with the control officers, this is thought to be because of traditional attitude of officers to be turn a blind eye/keeping peace/being part of the local community/receiving gifts/be lenient/be compromised in their ability to tell the difference in matters of size (mesh and fish) while enforcement of "automatic" violations for which the officer cannot be blamed keeps contact impersonal.

Legitimacy of the decision rules and measures in general:

As with the Baltic Sea CS, the fishers expect and accept a system of regulation and control; none of the interviewees talked about "the good old days" of no regulation. In discussion of specific themes the fishers mix and interpret their own daily experiences with biological arguments (discuss interaction between species, influence of other factors as water temperature, spread of alien macrophytes or alien toxic fish, plastics in the sea and pollution from land, refer to scientific descriptions of fish and fish behaviour etc.), compare control measures between them and other bigger more powerful sectors and their ability to impact the sea (agriculture for example is an important sector who gets away with murder re: for example pollutes with no penalties). Frequent comparisons are also made with the numerous coastal fisheries, which except MLS regulations have minimal controls and these include lack of closed seasons and areas for a large number of them, lack of financial and administrative controls i.e. tax papers and waybills, and no obligation for VMS.

A number of the interviewees have participated in scientific fisheries research or gear trials and have experiences in interaction with biologists and other scientists. A number of them would be willing to participate again (and be paid for it) to find out about areas with big clean catches with less discards. A few of them they would be willing to participate again (and be offered small compensation for it) to find out about true margins/areas of Posidonia, so to update the maps and avoid the fines and penalties. In most cases they feel their expert knowledge of the marine system is ignored and their participation to research

surveys is not thought to be linked to any measures being implemented or any advice being taken up or less ignored. They feel more strongly about lack of scientific and fishers' knowledge in decision making and implementations of spatial measures. 1) They feel that most closed bays are closed for decades and forgotten closed with no re-assessment and without scientific proof of gains so far or future advantages. Closed bays are closed to extractive uses like trawling but not coastal (un-regulated and un-monitored) fishing and not polluting or impacting uses, and some feel there should be a closed season for all the fisheries in Greece with most proposing May as the best candidate month. 2) There is perhaps one of the very few examples of industry requested research funded studies (through the "Fisheries Operational Programme EPAL") and this is about proving loss of income and loss of vital fishing grounds with the implementation of the Mediterranean Regulation 1967/2006 and the ban of trawling in less than 1.5 mile distance from the shore (vs. the previous 1.0 mile). In this case they themselves think that their reaction was too late too weak not well thought out or coordinated and reactive enough and are not surprised to have being ignored and faced to their biggest loss of recent times.

In contrary to the BS situation, the Greek fishers in general are used to deal with simpler management measures based on effort control and spatio-temporal closures, they see no escape from that and are willing to continue on this path if needs be by "exchanging" more closed times and areas with effort displacement or more days-at-sea or some other form of compensation. The large majority of the interviewed fishers (14 out of the 16 plus 3 out of 3 of the pilot questionnaires) are in favour of closed areas in the event of too many juveniles, but most of them request that closures are supported by scientific evidence and that closures are truly spatio-temporal on areas and times of high juveniles' concentrations. Two fishers against this measure and two of those in favour have cited examples of permanently closed bays showing signs of degradation and reduced productivity. While still positive (11 out of the 16 plus 3 out of 3 of the pilot questionnaires) and in principle they state they are in favour of more MPAs or effort reductions ... these too have to be supported by sound evidence and any-(proven)-good-for-the-environment benefits traded in with other benefits including opening new areas to fishing or allowing fishing all year round in some areas or just plain subsidies. Some of them are in favour of closing May (reproductive period for many fish species) to all fishing in Greece "to save fishing" while some will want September open as "compensation". Five fishers were against the measure saying, "we have enough prohibitions already" and/or "what is the purpose, good out of MPAs anyway".

Essentially however all of them are against permanent closures and areas forgotten closed for many decades with no official redress, assessment of their status and in reality with nothing good to show for. Examples include closed bays with environmental problems, no gains (increased production) for coastal fisheries or bays so littered with plastics (from greenhouses) that they are no good even for illegal fishing.

Community

The identity of the Greek trawler is that of a maritime businessman, their office is the sea but often also their fish selling shops or their taverns. Coastal fishermen too have often second jobs and other market connections but these two are a class apart: re scale of operations in strategic investments and position in society (working class vs. middle class).

Descriptions of the ports/regions as communities

The interviewed fishers are fishing from 8 ports, 3 ports (Kyllini, Patra, Zakynthos) in the Ionian Sea (7 interviews) and 5 ports (Michaniona, Chalkis, Heraklion, Agios Nikolaos, Koilada Argolidas) in the Aegean Sea (9 interviews) (see Figure 1).

Norms regarding discards

Most of the fishers see discards as unavoidable part of their everyday practice and as a result of mixed fisheries. Discards to them are non-commercial species (waste of fuel money and space in the codend and potential cause of harm to good catch) and juvenile fish. They all seem to agree that discards have been reduced considerably now that the new 40 square mesh trawl gear is implemented and by that they explain that a lot of young fish escape through the non-closing square mesh, juvenile that they would be otherwise discarded. It seems that they are content with this arrangement and in fact in this case they would be willing to avoid certain areas/times of the year to avoid concentrations of juveniles and therefore discards (although temporary closures should/could be accompanied by increased access elsewhere). Loss of income through loss of juvenile catches is not stated as big loss and is easily compensated with some extra fishing. Apart from that they do not see the need for more selectivity increases or more selective gears, but they would not mind cleaner catches with less time lost in sorting and same or more profit.

They take the attitude of why discard something that has a value (and in fact they say “everything has a price”) and/or why discard something that cannot be returned alive, while also taking the opposite stand “it is dead anyway and it will feed the fish and benthos and seabirds”. Their attitude towards discarding of commercial species over MLS (high grading) is somewhat different pre and post crisis but their criteria in both cases are financial not moral. Because of the crisis there is higher demand for cheaper fish there is less need for high grading and because there is crisis there are more poor people in need so there are a few tales about and a few documented cases of giving discards for free to the poor. There does not seem to be moral issues or reservations toward catch of turtles (returned alive), dolphins (?) and infrequently sharks (commercial and sold as such or for other look-alike commercial species). One of these sharks is the basking shark *Cetorhinus maximus*, included in the texts of Bern Convention, CITES and Barcelona Convention as strictly protected fauna species and in the List of endangered or threatened species, and currently assessed as threatened and listed as Vulnerable to extinction (IUCN Red List criteria, Cavanagh & Gibson 2007) (but main and historical culprit is drift netting and continued illegal drift netting).

Thinking in ecological systems

In agreement with the BS CS in general the interviewed fishers expressed an experience based thinking and understanding of the complex interaction between species and other natural conditions for the fisheries. They believe that the discarded material is not lost, but recycled either by marine fauna or by seabirds that will starve if they stopped discards and in that sense they are not wasted. They feel that their inputs and impact to the sea are less harmful than that of other human uses including agriculture, tourism/recreation and climate change with rising temperatures and spread of alien species. The increasing presence of the alien macrophyte *Caulerpa racemosa*, causing loss of habitat functions, and of the toxic fish *Lagocephalus* that spreads undeterred as it has no enemies, are seen as the manifested result of lack of control on pressures (and state) of our seas. No mention however of some of the aliens (fish, molluscs, crabs and others) being established as of moderate commercial value for inshore coastal fisheries.

Economic approach to discards

Even post-crisis, within an economic approach discard of non-commercial species and some low paid species was regarded as acceptable and good economy. Provided there is some form of compensation and appropriate infrastructure ashore and outlets (markets or uses) it was not regarded a total waste of space and fuel to land non-commercial species and organisms. Some fishers stressed practical problems of handling the volumes of “useless” material especially as the local authorities cannot even handle the volumes of litter that the fishers return as part of a voluntary clean up scheme.

Political approach to discards

In the biological and economic approach the fishers seem to regard discards as only a small problem, and increases in selectivity and changes in market demands contributed to reduced amounts. Seen from the fisher perspective discards is rather a political/legislative problem, i.e. through MLS prohibitions but these are not enforced or respected. Discarding is not a “live” big-deal issue on the Greek fishing political or moral agenda and indeed media coverage (shaping public opinion) usually focus on overfishing aspects, fish disappearing and reduced catches and income especially for coastal fishermen. This is very crudely corroborated by a simple keyword Google search in Greek language: overfishing and discards in Greek return 75200 and 21800 results respectively. Their contribution to overfishing is another matter and there they portrayed less favourably than the coastal fishermen.

The fishers’ active steps to reduce or avoid discards

The fishers’ passive steps to reduce discards are part of their compliance in using more selective gears and in fact more selective mesh size or mesh type. Implementation of these measures usually takes time (i.e. long delays are expected before full compliance) and these changes are not very often (previous change from 28 mm diamond mesh to 40 mm diamond was in 2001, and the most recent change from 40 mm diamond to 40 mm square or 50 mm diamond was regulated in 2006, with beginning of enforcing implementation 3-4 years ago in 2009-2010). While there are no fishers “active” steps to reduce discards, there are cases of avoidance of juveniles and of areas considered to have too much “trash” messing up the catch or wasting time and money in sorting.

Knowledge about fishing places etc. is not exchanged between the fishers in any configuration (social groups, ports etc.). VHF and cell phones are used for small talk and weather updates. On the contrary gear performance (pros/cons/specificities e.g. changes in durability or use of fuel) are discussed more openly at their unions and between them. The same is true for investments in equipment (winches, sonars, etc.). They do not talk about it and they are not interested in developing any technical solutions to reduce bycatch or discards. In addition their choice of gear is not influenced by selectivity/bycatch/discards, as it goes more or less with their strategic choice of investments (i.e. vessel type and size).

Identity: The fishers are rough-handed/hard done and portrayed as responsible for overfished stocks

In general the fishers feel they have “done what we were told to” every time over time: they are the most hard-done regulated part of the Greek fishing industry and they have sustained gear changes (new trawls with larger meshes), compulsory annual closures of 4 months, additional closed areas or zones or times,

electronic spying/recording by VMS, recent prohibitions of fishing on maerl/corraligene and on Posidonia meadows, and most importantly the recent loss of the fishing grounds between 1.0 and 1.5 n mile. They feel that coastal fishermen are much freer with much less prohibitions and controls but their political value (as voter power) is much higher as they are thousands (approx. 17000 vs. 300 trawlers) and their identity is perceived to be the traditional low impact low income one, although their share in the state of our fisheries and marine resources is perhaps considerable.

They seem to be expecting to be able to arrange trade-offs i.e. more closed months should be followed by more open areas or subsidies. In general they hope there will not be any more measures despite overfishing signs but realistically expect more hard measures which they fear will drive the sector to its extinction as already they are experiencing survival problems, a few of them faced with the financial crisis and VMS fines are hoping for subsidies to scrap their vessels.

The identity as fisher was not an explicit theme during the interview. Most of the interviewed had been fishers all their life and came from fisher families – with references to fathers, uncles etc. as fishers. But no data were collected on how many of them had sons in the fishery. The coastal fishery sector is an aging sector with the younger generation not choosing the fishing profession but no data on the trawl sector. However the roles are different, in the trawl sector the Greek is usually the owner and Captain (a more of a white collar role than fish scale covered role) and the crew is usually Egyptians.

Market

The market is expected to be an important driver for discarding certain types of the catch for which there is no market at all or very low prices. But also there are cases, when if there is a market for e.g. undersized fish due to low enforcement and compliance they are landed, resulting in lower discarding.

Value of landings in Greece

The total annual gross income from capture fisheries per trawl vessel was 263569€ for vessels less than 24 m and 430475€ for vessels more than 24 m length in the Aegean Sea. In the Ionian Sea these values were 307025€ and 397633€, respectively (NSSG, 2008).

The highest annual gross income per species per vessel for 2008 was attributed to *Merluccius merluccius* for both Aegean and Ionian Sea. In the Aegean Sea the annual income for the hake per vessel for vessels 12-24 m were 61151€ and 108406€ for vessels >24 m. In the Ionian Sea these values were 87717€ and 139462€, respectively. *Mullus barbatus* has also possessed a large proportion of the annual gross income in both seas. Cephalopods and mostly *Loligo vulgaris* had a large contribution to the total annual gross income in the Ionian Sea.

Market related discard from Greek waters

Based on the results from the Badminton project (Eliassen & Christensen 2012 and Catchpole 2012) one could expect market related discard of species with no market or with very low market price. The reason for discarding already caught marketable species is very small size below MLS or damaged specimens.

Considerations regarding Minimum Landing Sizes

Generally Minimum Landing Sizes, MLS is regarded as a conservation measure aiming to protect juveniles till they reach their first sexual maturity. The fishers are obviously not happy with regulations that potentially force them to discard marketable fish, however MLS control is not actively enforced and in cases of certain at least target species landed specimens are of sizes smaller than the MLS.

Direct sales costs for low paid species

The interviews revealed that in the middle of a financial crisis “everything has a price” and there is increased demand for some cheap species, which leads to less discarding.

Interpretation of cost in relation to discard

Not only the market prices, but also the cost (direct or indirect) influences the fishers’ interpretation of net income from handling the specific catch. Various factors seem to influence this:

- Expected price at the market and income from sale for each species
- Direct costs related to landing (sorting boxes, ice, auction and port charges)
- The effort of handling/time spent sorting can in some instances be seen as indirectly too costly for some low paid species. The crew in charge of sorting the catch are typically foreigners (Egyptians) very experienced in this job with good knowledge of species and markets and under instructions from their captains what to keep or not at the beginning of the season or during special seasons; their pay is either with fixed salary or catch value shares.

Technological investments

In general most vessels are relative old while their average age was estimated at 22.63 years (Conides, 2007). The larger recent investments include the new trawl (40 sq or 50 d mesh) and smaller investments/any updates in sonars/plotters and trawl wires/doors etc. None of the investments are directly linked to the reduction of discards.

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Appendix 3: The English case study: Three trawl fisheries in NE, NW and SE England.

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Introduction to the case study

The third case has a quite different structure than the previous. The English case consists of three separate studies done on behalf of CEFAS with the purpose of “gain a deeper understanding and insight into the behaviours of fishermen, including the barriers, incentives, disincentives, rewards and opportunities for changing discarding behaviour” and to “identify effective mechanisms to facilitate behaviour change”. The studies were made in 2009 and 2010 by “The social marketing gateway” (Prawn trawlers of North East of England) and Corporate culture (Devon Beam trawlers and nephrops trawlers of North West of England).

The three studies were made in a social marketing approach focussed on understanding behaviour of fishers to gather their understanding of influences and drivers of discard and their eventual ideas for how to reduce discard. The data gathering was based on around 20 interviews with fishers and supplementing interviews with related persons or gate keeper to the fishers. The interview results were reported in three reports; “Scoping study: actionable insight into discarding behaviours of trawler men in the North East” (McArthur & Howick 2010), “Project 50 per cent. A Cefas project to reduce discards amongst Devon beam trawlers by 50%” (Corporate Culture 2009) and “Actionable insights into the discarding behaviours of fishermen in the North West. Final report to Cefas and Defra” (Corporate Culture 2010).

As the focus and methodology was very close to the methodology of the WP 4, the reports describing the results have been used as the sources for the English case study. In this report we have extracted elements from the report to the list of potential factors for discard and a few lines describing the fishery in correspondence with the structure of the Danish and Greek cases.

The nephrops trawl fishers of North East England

The description is based on qualitative interviews with 30 respondents of which 22 were local fishermen and 8 other stakeholders, mainly gate keepers or contact persons to the fishers.

The following are based on: McArthur & Howick 2010. Scoping study: actionable insight into discarding behaviours of trawler men in the North East.

Table 1: The list of factors driving toward a higher or lower discard level

	Drivers for high discarding behaviour	Drivers for selective/low(er) discarding behaviour
Natural conditions	<ul style="list-style-type: none"> ▪ Incompatibility between the amount of fish caught (high) and the available quota (low) ▪ Helps getting rid of Whiting that feed on and keep the Prawns away, thus contributing (in a small way) to creating ‘cleaner’ Prawn fishing. 	
State	<ul style="list-style-type: none"> ▪ Low (and falling) quota allocation means the fish cannot be legally landed ▪ Inflexibility in quota controls stops boats carrying forward unused monthly quota 	

	<ul style="list-style-type: none"> ▪ Inflexibility in the Track Record means that a boat’s quota does not reflect the mix of species that they currently catch ▪ Strict application of / lack of flexibility in the Catch Composition rule means bi-catch is discarded even where there is enough quota ▪ Severe costs and penalties associated with landing illegal fish ▪ Tightening of Effort Control motivates the boats to fish harder when they are at sea to get higher return of limited days-at-sea ▪ Restriction on the >10 meter boats carrying two nets prevents them from switching from a smaller to a larger net mesh size when fish are on the Prawn grounds ▪ Not being able to purchase additional quota (only applies to <10 meter boats) 	
<p>Market</p>	<ul style="list-style-type: none"> ▪ Increasing economic pressures on the fishermen and decline of the fishing industry ▪ High price of purchasing quota (compounded by the operation of ‘slipper skippers’) compared to the expected market price for the fish ▪ Lower costs – in time and fuel – than having to look elsewhere for areas with “cleaner” prawn grounds 	<ul style="list-style-type: none"> ▪ A sense of economic waste associated with discarding fish that there would be a market for in e.g. catch composition regulation. ▪ Catching less unwanted fish reduces net bulk which makes it easier to tow and therefore uses less fuel ▪ Clean catches of prawn, where there is no discarding required, are of better quality and value ▪ Blacking the fish and selling them illegally, where the expected price outweighs the risk of being caught
<p>Community</p>	<ul style="list-style-type: none"> ▪ Resignation and pessimism that nothing will change, so ‘what’s the point’ of fishing more selectively ▪ Staying on the right side of the law and avoiding prosecution associated with illegal landings ▪ Recognition, e.g. being part of a sustainable fishing scheme (although few of the fishermen probable feel they can credibly be part of such a scheme due to the level of discarding they are involved in) 	<ul style="list-style-type: none"> ▪ Using their knowledge of the sea to do the job well and ‘fishing normally’ in a balanced and sustainable way. (NB currently perceived to becoming less of an option due to Effort Control) ▪ There is less work involved if you do not have to sort and dump the stock you cannot land. ▪ Consensus across the fishermen that discarding is wrong and cannot be justified ▪ A belief that the practice of discarding serves to undermine the sustainability of the local fishery and their future livelihood

		<ul style="list-style-type: none"> ▪ A suspicion that there may be unknown, negative environmental consequences associated with a high level of discarding ▪ An appetite to try out new practical ideas that offer a realistic way of reducing discarding without adding costs or reducing income ▪ A sense that discarding reinforces a negative public view of fishermen as being wasteful
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Natural conditions for the North Eastern English fishery

The North Eastern English prawn fishery is mixed. Besides prawn, the main commercial species is whiting. Other fish species include cod, haddock, plaice and lemon sole.

Whiting is perceived by the fishermen to be in high abundance (despite low quota), while the prawn stock is seen as diminishing. As whiting feed on prawn, the whiting abundance paired with restrictions on the fishing of this stock, is thought to pose a threat to the prawn stock.

In order to target prawn all year round, while reducing the by-catch of whiting, some fishermen move out of their local fishing area in search for “cleaner” prawn grounds.

The discard situation

Previous research has estimated the level of discarding within the industry at around 50%.

Discarding is recognised by the fishermen as being a significant problem, according to the fishermen mainly because the quotas were set too low in relation to the abundance of whiting.

The fleet

The local fleet numbers around 30 boats. Most of the skippers either own or part-own their boat. In recent years the size of the fleet has declined now comprising fewer boats, with the smaller boats (<10m) representing a larger proportion of the fleet. Previously it was a more mixed fishery, but it is now moving towards a predominantly prawn trawling fishery.

State: The regulation of the North eastern English fishery

The quota system sets catch volume and catch composition. The catch composition depends on the day boarded, not what the composition is at the end of the trip. This means that catch with very low level of e.g. whiting one day cannot outweigh a high level of whiting the next day. This leads to discard of fish the

second day.² The regulation also includes Days at Sea for vessels >10 meters and there is regulation on the types of gear allowed. The quota is distributed according to boats' historical track records.

Catch and quota development

The boats often run out of whiting quota, and so try to either catch more prawns and/or buy whiting quota, which however is becoming increasingly expensive.

Fisher consideration regarding control and legitimacy

The whiting quota allocation is much criticized for being far below a reasonable level if compared with the whiting available, according to the fishermen's experience³.

External twin riggers are perceived to pose a threat to the local fishery by contributing to overfishing the prawn. There is thus a strong local support for tightening the control on twin rigs and possibly extend their limit to no closer than 12 miles from the coast.

Control and enforcement of regulations and penalties are perceived by the fishers as being severe.

Community

The fishermen feel threatened by tightened regulation and economic pressures and are frustrated and worried about the sector's future.

Discard is widely believed by the fishermen as being morally wrong and potentially harmful to the marine ecology and the fishermen's livelihood. However it is also perceived as an inevitable part of the fishing activity, due to the current low quota levels.

The main reasons for discarding, according to fishermen, are:

1. The quotas are too low compared with the stock abundance (especially for whiting)
2. The implications of rules related to catch composition and effort regulation

Fishermen responses aimed at limiting discarding:

- Checking the market price (the price has a direct bearing on the decision whether to discard or not)
- Using a square mesh size larger than the minimum required
- Fishing lower - lowering the height of the net, to avoid by-catch of fish when fishing prawns
- Trying to avoid areas with high density of fish (based on local knowledge)
- Fishing further out at sea

Fishermen responses that do not limit the discarding:

² "The current Catch Composition rules for nephrops trawling, where the on board catch of Prawns and by-catch has to fit a certain ration, directly contributes to discarding. A relaxation of this rule so that it applied to landing or how Catch Composition is treated south of the 55 degree line (where Whiting is included with nephrops in the ration) would help make a difference" (McArthur & Howick 2010, p. 27).

³ "The key issue in the North East and the UK is insufficient Whiting quota to go around given existing fishing capacity. Other European countries, such as Norway and Sweden, are utilising very low levels of their Whiting quota. At the moment, the only way this could be shared/exchanged with the UK is through negotiation between countries at EU Commission level" (ibid: 28).

- Accepting discarding as inevitable
- Landing illegally, selling on black market

Market

The boats often run out of whiting quota, and so they try to either catch more prawns and/or buy whiting quota, which however are becoming increasingly expensive. Whiting quota may cost £20 a box, yet the income for the fisher might be only £25 –at other, better times, the income might reach £50-60.

The expected price has a direct bearing on the decision whether to discard or not.

There are some illegal landings and a black market exists, but the extent is unknown.

The local market is good for whiting and prawns, as well as cod, haddock, plaice and lemon sole, while other species caught in the area are more easily sold in ports further south.

The prawn trawlers of North West England

The interview persons for the study was 23 prawn fishers in the ports of Whitehaven and Maryport, and a number of local Cefas staff, local fisheries officers, a local NFFO representative and a local Defra policy official.

The following are based on: Corporate Culture 2010: Actionable insights into the discarding behaviours of fishermen in the North West. Final report to Cefas and Defra . The Social Marketing Gateway. May 2010.

Table 2: The list of factors driving toward a higher or lower discard level

	Drivers for high discarding behaviour	Drivers for selective/low(er) discarding behaviour
Natural conditions	<ul style="list-style-type: none"> • Changing stocks including more unusable fish such as juvenile plaice ▪ In order to capture prawns in nets it is necessary to use relatively small mesh sizes, which means catching some levels of unwanted fish 	
State	<ul style="list-style-type: none"> ▪ Unflexible net legislation (due to cod protection) means fishermen keep the small meshed prawn nets on all the time rather than changing according to the conditions ▪ Monthly (instead of annual) quotas for cod and turbot would reduce their need to discard good marketable fish 	<ul style="list-style-type: none"> ▪ Suggestion: Two hour restriction of trips might reduce discards (because short trips limits the discard biomass in the nets that blocks for “good” catches ▪ Suggestion: extension of the in-shore zone would keep twin-riggers with much discards out
Market	<ul style="list-style-type: none"> ▪ Expensive to invest in new more selective equipment ▪ Increasing economic pressures on the fishermen and decline of the fishing industry ▪ Bad market value of dogfish of which 	<ul style="list-style-type: none"> ▪ Catching less unwanted fish reduces net bulk which makes it easier to tow and therefore uses less fuel ▪ Reduced level discards in the nets leads to better quality fish and thus higher profits

	<p>they catch many</p>	<ul style="list-style-type: none"> ▪ Suggested incentive: Subsidies for new more selective gear and payment for participating in scientific trials ▪ The species that are discarded are with no or very little market value (unlike the two other English cases), so there is genuine incentive to avoid catching them ▪ Clean catches of Prawn, where there is no discarding required, are of better quality and value
<p>Community</p>	<ul style="list-style-type: none"> • Some believe that the juvenile plaice will never be bigger/mature (due to genetic or environmental factors), which removes the incentive to preserve them • Some not convinced of the benefits from technical or behavioural modifications (requests more evidence) • Some fishers had the experience that plaice swimming down when caught in the net, thus not using escape routes built into the nets 	<ul style="list-style-type: none"> ▪ Acknowledgement that the stocks are declining and there is a need to protect them ▪ Ideas for changes in practices that might reduce discards (using pots, escape hatches, nets without bridles, nets with separators, veil nets, limitations on braid size, limitations on diamond shape mesh) ▪ Willingness to adopt new approaches and equipment ▪ Widespread willingness to participate in and learn from technical trials (if not too costly for them) ▪ There is less work involved if you do not have to sort and dump the stock you cannot land (particularly important because these were small scale boats where the owners also worked –so incentive to avoid hard unnecessary work) ▪ A belief that the practice of discarding serves to undermine the sustainability of the local fishery and their future livelihood ▪ Interest in participating in a “sustainable in-shore fisheries” programme ▪ Heavy laden nets (with much discard material) are dangerous to tow

Natural conditions for the North Western English fishery

The stocks are changing; especially the large scale cod stocks are disappearing. The remaining (few) cods are smaller. There are also decline of other large fish such as whiting, haddock, squid, monkfish, turbot and bill. More flat fish such as plaice, often juveniles on the prawn fishing grounds. Recently increase in herring stocks. These changes are the main reason fishermen have changed target species to prawns.

Unlike the Devon and North East cases, the fishermen in this case did not believe that there were plenty of fish and thus understood the reason for many of the regulations.

The discard situation

Main species that are being discarded are juvenile plaice, dog fish (bad market), dabs (no market value)

The fleet

Prawn fishermen, most of them work in 2-3 man crews with a few of them working in crews larger than 3 men. Small boats, mainly <12 meters. Around 22-23 boats fishing for prawns distributed in the 3 ports investigated. Mainly full-time fishermen.

The fishery is under pressure due to changing fish stocks, rising fuel costs and declining fish prices.

State: The regulation of the North Western English fishery

Quota was not found to be a major issue in the NW prawn fishery, as they tended not to reach them due to bad weather, high fuel prices and low stocks.

Catch and quota development

For this part of the fleet the quota is not a limitation for the fishing activity. They claim not to be able to fish the whole allowable quota anyway.

Fisher consideration regarding control and legitimacy

Contrary to the findings in the Devon case, the fishermen in this study tended to have good relations with the fisheries officers.

Community

Fishermen attitudes towards discards: they recognise it as a problem because they lead to:

- Unwanted, unprofitable, hard and sometimes dangerous work.
- The fishermen do not like to kill unnecessarily
- Discarding is seen as endangering future stocks and thus their livelihood

There is a relatively close cooperation between the fishermen in the group. They are not well represented in national organisations and feel competition from the Irish twin-rigger fleets which fishing at the nearby fishing grounds with a high catch and discards.

Interestingly, the fishermen in this case did not feel under pressure from environmentalists or a bad public reputation. Rather a feel that there is too little public attention on their fishery, so that they were forgotten in political negotiations.

The fishers claim interest in participating in a “sustainable in-shore fisheries” programme.

Market

No mentioning of a black market for illegally landed fish. The bad market for dogfish is a major reason for the discard of this species.

The beam trawlers of Devon

The interview persons for the Devon study was 13 beam trawlers (fishermen, skippers), 13 owners and industry leader and CEFAS researchers, industry leaders, fishery officers, Defra policy officials.

The following are based on Corporate Culture 2009: Project 50 per cent. A Cefas project to reduce discards amongst Devon beam trawlers by 50 %. Social Marketing Research Report 2009

Table 3: The list of factors driving toward a higher or lower discard level

	Drivers for high discarding behaviour	Drivers for selective/low(er) discarding behaviour
Natural conditions	<ul style="list-style-type: none"> ▪ Incompatibility between the amount of fish caught (high) and the available quota (low) ▪ A belief that most of the discarded fish and other species survive 	
State	<ul style="list-style-type: none"> ▪ Low (and falling) quota allocation means the fish cannot be legally landed ▪ Strict enforcement and policing attitude of authorities is detrimental to the relationship with the fishers 	<ul style="list-style-type: none"> ▪ Compensation such as additional quotas or days at sea would give incentives to adapt more selective fishing practices
Market	<ul style="list-style-type: none"> ▪ Increasing economic pressures on the fishermen and decline of the fishing industry ▪ High price of purchasing quota and uncertainty whether changing EU decisions will make investments worthwhile 	<ul style="list-style-type: none"> ▪ A sense of economic waste associated with discarding fish that there would be a market for. ▪ Catching less unwanted fish reduces net bulk which makes it easier to tow and therefore uses less fuel and requires less sorting work ▪ Awareness of consumer demand for fish from sustainable fisheries
Community	<ul style="list-style-type: none"> ▪ Resignation and pessimism that nothing will change, so ‘what’s the point’ of fishing more selectively 	<ul style="list-style-type: none"> ▪ Consensus that discarding is wasteful and that certain types may be ecologically detrimental

	<ul style="list-style-type: none"> ▪ Conviction that the science is “wrong” and there are plenty of sole 	<ul style="list-style-type: none"> ▪ Interest in learning from technical trials on how to reduce discarding and demand for higher accessibility of such knowledge ▪ A sense that discarding reinforces a negative public view of fishermen as being wasteful
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Natural conditions for the Devon beam trawl fishery

According to the fishermen interviewed the sole stock is in high abundance, but following natural fluctuations. They believe the science showing low abundance is flawed (partly due to “cheating” of the industry in the past), and hence that quotas are too low.

The discard situation

The report does not mention the average discard level. It is mentioned that at vessel or trip level the catches contain between 10 % and 70 % discards.

Fishermen attitudes towards discarding:

It is important to distinguish between discards if benthos (unmarketable fish and shellfish, debris, sea anemones and decaying matter), juveniles fish and over quota fish. The fishermen perceive discards due to quota restrictions a waste. As catching juveniles is recognised as being harmful to the stock, these are only caught as by-catch, and must be discarded due to MLS regulations. Avoiding benthos would be an advantage. There is thus a positive attitude towards lowering discards. However, they would expect to be compensated by additional quota or days at sea in return for adopting measures aimed at reducing discards.

The fishermen are convinced that a high proportion of the discarded fish and other species survive, as they do not appear in the catches.

The quota system and the Single License Agreement is perceived as causing discards, which has become inevitable due to further quota restrictions. They believe that it is impossible for them to avoid species for which they do not have quota.

They are generally positive towards using nets with larger mesh size, but they need the flexibility to carry different types of nets for different areas.

The fleet

Beam trawlers. Main target species is sole.

State: The regulation of the Devon beam fishery

Regulation mentioned in the report: The Quota system; a Single Licence Agreement which means that the fishers have to go back to port and register catches from one fishing area, before going out to another area to catch more fish and regulation of days at sea.

Communication:

The Devon fishery has a strong connection with one producer organization, but not so much with the NFFO, which is the main national industry body that consults with the authorities. The Devon fishery therefore feels excluded from the consultation process.

There have been different kinds of trials with mesh size and shape carried out in Devon, but the fishermen feel that the results have not been widely shared and technical guidance is lacking on how to reduce discards.

Catch and quota development

EU meeting in 2006 resulted in a lowering of the quota, particularly of sole.

Fisher considerations regarding control and legitimacy

The fishermen feel that the act of buying quota is risky, as they cannot predict whether such purchase will pay off, or whether a new EC decision might suddenly cut off quotas for their most important fishing ground. On the other hand the quota system forces the fishermen to be flexible, swapping and renting quota and fishing grounds. They find that they have to go out further than before in order to make up for lost income in the local areas.

The fishermen are highly critical of the Single Licence Agreement, which makes their work less efficient.

Community

Crew skippers and owners agree that:

- Fishing is not an exact science –lots of “trying areas out” and moving around required (also for experienced fishers).
- Seeing themselves as part of an innocent and ancient tradition, honest and benefiting the community (food and jobs) and the fishing grounds (good to be ploughed). “Custodians” of the grounds.
- Internal community feeling, supporting each other (not competing –which is contrary to previous findings).
- The Devon fishermen do not feel represented in NFFO, the national industry organisation, and thus feel excluded from consultation processes between the authorities and the industry
- Worried: Participating in a financially precarious and dangerous occupation
- Too much control
- Fishermen are (wrongly) being seen as criminals. Feel they are scapegoats
- Belief that there are plenty of fish –when stocks are apparently declining it is due to natural fluctuation