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**The Badminton project: D3 Report in the Badminton project work package 4: Socio-economic and institutional incentives for discarding**

*Socio-economic and institutional incentives influencing fishers' behaviour in relation to fishing practices and discard*

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**The Badminton project: D3 Report in the Badminton project work package 4: Socio-economic and institutional incentives for discarding:**

**Socio-economic and institutional incentives influencing fishers' behaviour in relation to fishing practices and discard**

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**October 2012**



Greek trawler operating in North Aegean Sea.



The BADMINTON project (Bycatch And Discards: Management INDicators, Trends and locatiON) is supported by the MARIFISH project with financial support of the European Union and national ministries. (<http://83.212.243.10/badminton.html>).

## 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). The framework was used for analysing factors influencing discard behaviours in three case studies; Nephrops trawl fishery in Kattegat (Denmark) and Otter trawl fishery in the Ionian and the Aegean Seas (Greece) and an English case of three trawl fisheries in NE, NW and SW England. In the D2 report the case studies are summarised and the framework and list of factors are evaluated (Eliassen et al. 2012).

In fact this paper is in draft of a manuscript for a peer reviewed article. This version was presented at the ICES Annual Science Conference in Bergen in September 2012. The text has later been revised and is expected to be published in the ICES journal of Marine Science in a special issue. The format of a manuscript is therefore maintained.

## Socio-economic and institutional incentives influencing fishers' behaviour in relation to fishing practices and discard

Søren Q. Eliassen(1), Nadia Papadopoulou (2), Vassiliki Vassilopoulou (2), Tom Catchpole(3)

Discard of unwanted catches are common in European fisheries. The proposal for reforming the CFP by 2013 gives high priority to reduce or even ban discard. Various measures are already in use. However, there is no in-depth understanding of the underlying socio-economic and institutional incentives and factors causing discard at the individual fisher level.

The paper presents an approach of seeing discard as result of decisions in the sorting at the deck as well earlier in the planning and implementation of the fishing. When the behaviour in the fishing practice of decisions results in a more selective fishery than average it could be seen as selective behaviour. It is argued that the fishing practise is institutionally embedded in three institutional orders; the state (primarily the management system), the market (demand and price formation) and the community (norms and identities), which together with natural conditions create incentives and frameworks for discard/selective behaviour. Based on this a specified list of factors which potentially influence the discards and selective behaviours has been developed. The list is applied on three case studies; Nephrops trawl fishery in Kattegat (Denmark) and Otter trawl fishery in the Ionian and the Aegean Seas (Greece) and finally an English case of three trawl fisheries in NE, NW and SW England. The paper briefly discusses cross case findings of how the factors of the list in isolation and together create drivers for discard. Finally the paper evaluates the list of factors as a tool for analysing drivers for discard or selective behaviour in a context of developing mitigating measures.

Keywords: Driver for discard; institutional and socio-economic incentives; Case study comparison.

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## *Introduction*

In fishery it is practically impossible to totally avoid the catch of fish or other organisms which cannot be sold or cannot be landed due to legal reasons and is therefore unwanted in the catch (Pascoe 1997). The dominant answer to this is to discard the unwanted part of the catch. We here define discards as the proportions of both target and non-target catches discharged back overboard, either 'live' or 'dead' (Rochet and Trenkel 2005).

Discarding parts of the catch has different implications depending of the perspective. From the assessment perspective it is a problem to get good data on the amount and composition of discards (except for discard observations which is quite costly), creating uncertainty in the recommendations of allowable catch level. In an economic perspective discards (of marketable individuals) are seen as economic waste or waste of human nutrition, whereas environmentalists tend to see discard as a waste of biomass and disturbance of the natural balance. Following this, all or some parts of the discards are seen as the central problem to be addresses.

At the political level discards are regarded as a central problem (EU Commission 2007, Kelleher 2005). But it is dealt with in different ways across management systems. Some Nordic countries have prohibited discards, though with some modification (Johnsen and Eliassen 2011), as well as Iceland and New Zealand (Aranda and Christensen 2009, and Christensen 2009). Until now the EU has prohibited discards of fish for quota species, which can be landed legally (high grading), whereas it is legal to discard non-commercial fish and organisms and even compulsory to discard fish, which cannot be landed legally due to minimum landing size or quota regulation. But in relation to the 2012 revision of the EU Common Fisheries Policy discard ban is discussed as a central element (European Commission 2007 and 2009, Damanaki 2012).

A discard ban in itself is difficult to police, which is also the experience in the countries with a discard ban (Johnsen and Eliassen 2011). In an EU context use of new monitoring technologies (like video monitoring) is discussed, often in combination with catch quotas (all catches are registered at the quota)<sup>1</sup> in order to create an incentive to accept the control measures (Dalskov et al. 2011). Whether the discard ban works as a demand-and-control measure or more on a voluntary basis, creating incentives for the fishers to reduce the discard within the possible limits is of importance. Therefore understanding what creates incentives for changed behaviour is a necessity to support the intention of reducing the discard level by using existing or developing new measures.

## *Discard in the fishing process*

Discards is a by-product of the fishing process. The process of discarding takes place in the sorting process on the vessels right after the catch has been taken on board. What is caught is (partly) a result of choices made earlier in the fishing process, right up to the trip (choice of gear, fishing place and time etc.) and the strategic choices (choice of vessel, investments in quotas and catches and dealing with the equipment etc.).

What is caught is influenced by several choices before and during the fishing. This includes the long-term strategic choice of investment in the vessel etc., as well as shorter time tactical choices regarding the gear used at the actual trip, the use of it and the choice of fishing time and place (Christensen and Raakjær 2006, Eliassen et al. 2008). Here we will mainly focus on the short-term,

tactical choices and regard the long-term as a more or less given condition for the individual fisher. Though long-term investments buying or selling quotas (in regions where this is possible) will be seen as a part of the tactical behaviour to adjust the quota mix to the actual catch.

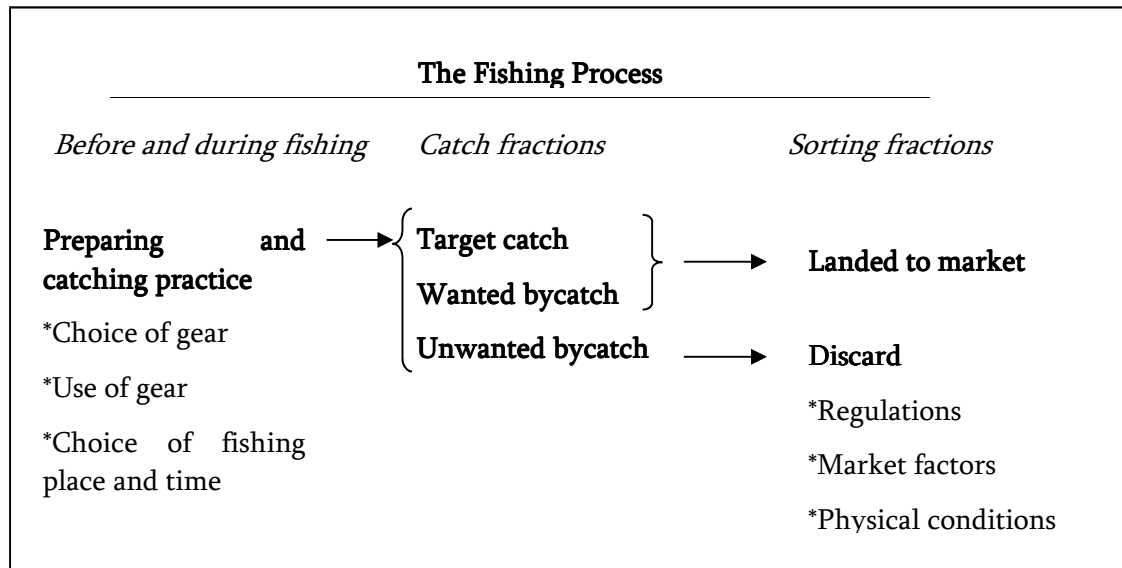
Choice of gear is decisive for the catch opportunities, both type of gear (trawl, net, longline etc.) and configuration of this (mesh size, grids, pingers, hook size etc.). The gear types differ in attraction selectivity (e.g. pots to trawl in nephrops fishery) and contact selectivity (mesh sizes, escape windows, grids etc.) (Catchpole and Revil 2008). The way the gear is used also affects the contact selectivity; e.g. the effective mesh size of a trawl may change depending on the speed of the vessel, which is why the diamond mesh (less dependent of the strength of the pull to size) has been implemented.

The fisher's choice of fishing time and place is another factor, which influences the catch and the selectivity. In a dynamic environment as the sea no one can go directly for fishing with no or very little unwanted catch. Though, over time the skipper gathers information about good (or bad) fishing places, often combined with information about other factors such as time of the year, previous and present weather conditions, even the level of daylight (sunshine/clouded) (Catchpole 2005). This is central knowledge for the experienced skipper, which is used for optimising the landings, but eventually it can also be used for avoiding unwanted catch if this element is recorded by the skipper. This factor is reflected in management as closed areas on a permanent basis (marine protected areas), in certain periods of the year (e.g. in spawning periods) or temporarily closed areas based on fishers information about e.g. many young fish in a certain area, as seen in the Scottish fisheries (Scottish Government).

At deck, other factors influence the choice of discard or holding back the more or less selective catch as described by Andersen et al. (2005) and Rochet and Trenkel (2005).

- Regulations; what can be kept according to the (EU) regulation - minimum landing sizes (MLS), general conservation rules, quota rights for the vessel etc.
- Market factors; what is the commercial value of the fish? Is it perceived at the effort worth handling, land and market the fish? Will it take up quota which could be used for higher paid individuals? (high grading) etc.
- Other physical limitations on what can be kept and landed; capacity and skills to handle the catch and capacity of storage, ice etc.

Figure 1: The main elements of the fishing process, where selective behaviour can be practiced, own model.



What is discarded is therefore a result of the preparing and catching practice and the sorting on deck as illustrated in Figure 1 above. Choices before and during the fishing process which leads to a higher selectivity and lower discard than in general in the fishery can be called a “selective behaviour” emphasising the importance of behaviour and choices of the fishers in the reduction of discards – in parallel with emphasis on the selective gear which is gear developed to a higher selectivity in the fishing process relative to the actual used gear.

#### *Institutional embedded behaviour*

How the individual behaviour (and thereby the choices) is influenced by external factors can be understood by the institutional theory. As Rudd (2004) emphasises the individual behaviour is influenced by *perceived* incentives of various capitals; natural, manufactured (technology), human (knowledge) and social capital. The latter, the social capital, is institutionalised as rules-in-use; e.g. formal rules and regulations as well as informal rules as norms and values for specific groups.

These capitals are anchored in three settings; Community, State and Market characterised by different institutional orders (Apostle et al 1998). As ideal types the Community is the lived-in human community based on interpersonal ties and egalitarian social networks governed by norms and values and social identification (the normative and partly the cognitive institutional pillar (Scott 1995). The State is based on formal institutions and structures of law, policy and governance, with specific regulations and decision-making procedures (technical and regulative measures), communication structures and formal control and enforcement systems. Finally the Market is characterised by competition, economic efficiency and (economic) rationality. In the real world the three settings interact and consist of different compositions of institutional orders ideally addressed to the other settings. As an example the market is an institution with its own norms and rules to be followed in order to function (Scott 1995). Apostle et al. (ibid) argues that the fisheries develop in the triangle of Community, State and Market. Likewise we will argue that the behaviour of the individual should be understood as a result of factors from these three settings.

Johnsen and Eliassen (2011) argue, in line with the previous that an institutional approach should be taken to a complex problem as that of discards. They claim that in order to understand the conditions for fisheries management, the natural/ecological conditions should be included as an important element. The natural conditions are very dynamic, but external to the individual fisher as well as the institutional orders (State, Capital and Market), although in the medium and long-term they may influence the natural conditions. In parallel the structural conditions for the fishery – mainly in form of fixed capital invested in the vessels of the fleet seems as a condition in the short run (Christensen & Raakjær 2006), while the structural conditions clearly are determined by State, Community and Market in the long run.

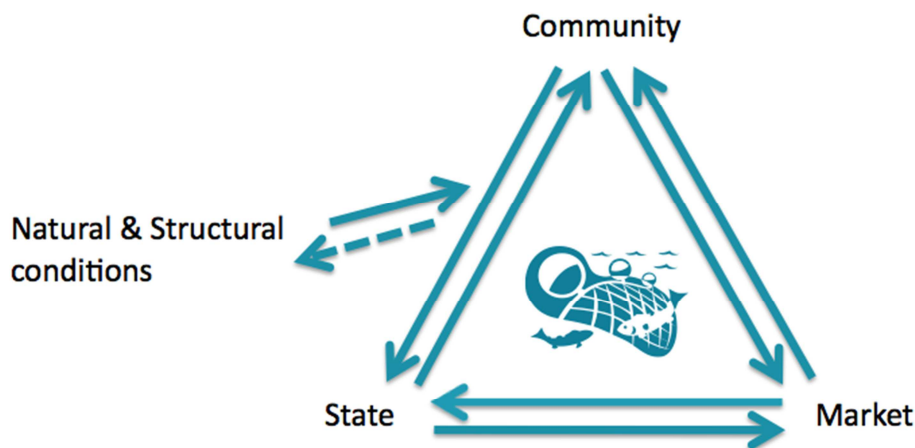


Figure 2: The model of the institutional embedded fishing practice. Fishing practise embedded in the Community, State, Market interrelation and the natural conditions.

The model of the fishing practice in the institutional framework intends to grasp the institutional analysis at the operational level where the tactical decisions in the day-to-day operations are performed.

#### *Factors potentially influencing the selective behaviour*

Claiming the behaviour to be embedded in the institutional triangle we need to identify the specific factors which potentially can influence the behaviour leading to discard (or not) in the fishing process. The specification is based on the development of Scott 1995. We will argue for specific factors within each of the institutional orders which theoretically can influence the behaviour leading to a higher or lower discard level. This list of factors will be tested in the case studies.

#### Natural and structural conditions

The natural or the ecological conditions in the sea and the targeted fishery are important for selectivity and discard. Generally there is a much lower discard level in fisheries targeting fish in schools than in fisheries targeting species in a mixed environment in regard species, size and year classes. Stock behaviour as natural variations in abundance, changes in position etc. also influences unwanted catch and discard. Other natural conditions can influence; sea bed conditions (e.g. limits



the use of gear types) or general weather conditions (e.g. waves can influence the functionality of the gear and the possibility of sorting and handling the fish aboard).

Large sums of financial capital are fixed in investments in vessels, equipment and training in fishing in a certain way. In a short time perspective the fleet structure is therefore hard to change radically and can be regarded as a condition for the individual fisher and therefore a fixed condition for behaviour.

### Community

The community is the social setting which influences the fishing practice. In most situations this could more or less be seen as the norms and values of the lived-in community for the fisher as the fisheries generally are still located in more or less fishery dependent or dominated communities. In some situations though “the community” could be a part of the lived-in community where fisheries are dominant or even a less geographic, more social defined community of a certain type of fishers, if this community – rather than the physical/geographical community - defines the values and norms in use in the fishery.

The community is mainly the domain of values and norms, but also cognitive elements as categories, typifications and meanings. The norms and values are maintained by conformity, which creates relatively stable cultural elements and sets conditions for- and limits the individual choices and actions. The individual feels a belonging to one (or more) social groups. The group are constituted by a set of *norms, values, morals and ethical standards*, which the individual tends to follow to avoid social sanctions. The social sanctions vary from remarks on improper behaviour from friends to the exclusion of the individual who does not follow the dominant norms in the group (Scott 1995). In general the norms and values are historically based and slowly adjusted to fit the surroundings. In this way the norms represent past experiences in the group. These experiences are deducted from the specific situations and “sunken” to be the norm or “the way it is done”. In that way the sum of experiences is generalised as knowledge within the group about how to do, it is *institutionalised knowledge*. Without being contrasted with other ways to do it, the norm is often tacit for those practising it. Still there might be an established basic understanding of the norms and institutionalised knowledge related to the discard behaviours among the fishers, as this could influence the actual choices (as seen in Nielsen and Mathiesen 2003).

While norms are generally sunken, categories, typifications and meanings are negotiated among the participants in an on-going and more reflected and cognitive process. In relation to the discards and (changed) selective behaviour, learning and redefinitions of the fishers’ roles and identities are central. The *identity* as fisher and especially the role in relation to the management system and extraction of nature influence the behaviour – the two extremes could be in the one end the fisher as the free extractor of the sea resources, delimited by the management and enforcement system, and in the other the fisher as an actor in a larger system with the aim of establishing an environmental and economic sustainable resource exploitation. As the role is under debate in many relations, one should be aware of the possibility of differences between the declared role and the performed role. Therefore the expressed roles should be registered as well as the role in practice.

The fisher’s role in relation to the management system and the discard avoidance can be seen in practice in various ways; e.g. in participation in *dialogues* with management, individual

registration of discards in order to learn how to reduce these, collective *learning* and experience exchange with the purpose of reducing discards etc.

## State and regulation

The setting of the state is the domain of rules and laws. In the EU context the overall policy framework is the Common Fisheries Policy. It sets the objectives of the policy, the regulations and specific technical measures as well as the rules for how these are decided and communicated.

*The regulations and technical measures* limit the conditions for the individual fisher's actions. For a specification it is important to understand the regulative conditions for the individual fisher/the group; who are allowed to fish (and eventually how the rights can be transferred), how are the limitations implemented in the fishing activity (the specific input and/or output regulation) and the supporting technical measures; specification of the gear for the individual fishery, any permanent or temporary closing of areas, discard rules (prohibited/compulsory) etc.

The *decision-making procedures* regulate the fishers' influences on the regulative outcome and the legitimacy of the regulations. This is highly important for the legitimacy of the regulations among the fishers, and probably also for the specific design of regulations and technical measures. Thus, in the case studies the formal procedures regarding the decision and design of the tool should be surveyed, as well as the fishers' perception of the process.

In this regard the specific *communication structures* between the fishers and the managers are important. These structures can carry information both ways; dialogues between fishers and management for designing useful technical measures as well as for communicating regulations for augmenting the implementation. The communication structures are the formal and the informal forums where fishers and managers can meet and discuss experiences of discarding, effects of selective gear and measures etc., advisory boards as well as dialogues during control sessions. The structures should be seen in a broad sense including the way the communication takes place; is it an open dialogue where problems and considerations can be exchanged or are a marking of positions and interests.

Finally an important part is the *control and enforcement* procedures and implementations. Control and enforcement is the tool for securing regulations to be carried out. For most fishers this is the main interface to the regulative system. The efficiency of the enforcement of regulations influences the fishers' incentives to follow the regulations, in this regard regulations influencing discards.

## Market

The market can be seen as social structures (Scott 1995, p. 51), characterised by competition, economic efficiency and economic rationality. Within this setting, the *economic incentives* are important factors for fishing as an economic activity. For the individual fisher the markets and the conditions (what can be sold and which price) are often perceived as given (though often fluctuating) conditions within a short-time period. The existence (or absence) of a market is a main driver for the choice of fishing activity at all and therefore also important for choice of discards (Catchpole et al. (forthcoming). The market signals can be more or less clearly interpreted

by the fisher in the various patterns reflecting prices for certain sizes, visible and intangible qualities (freshness, sustainability of the fishing and processing etc.).

The *available gear and vessel* are seen as a condition for the short-term decisions, which to a certain degree locks the fisher to a certain fishery due to his earlier strategic decisions regarding investments in the vessel and to a certain degree the gear (Christensen & Raakjær 2006). Radical shifts in the fishing methods (e.g. from trawl to net) can imply huge investments for rebuilding the vessel as well as learning to handle a new fishery, which can be a barrier to quick changes in the fishing methods. Existing equipment and gear also represent fixed capital, but in a minor scale. Therefore this can be seen as a field for action rather than a condition for action.

The concrete factors of the institutional settings (and natural conditions), which might function as drivers for the behaviour leading to a high discard level or a low (selective behaviour) are listed in Figure 3 below. These factors were tested in the case studies discussed below.

Figure 3: Specified list of factors which potentially influence the discards 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	Sea bed and other physical conditions Weather conditions
	Structural conditions – fleet structure	Fixed investments in vessels (and partly equipment)
Community	Dominant norms regarding discards	General view of discard Institutional knowledge regarding volumes, consequences etc. of the discard Social norm enforcement
	Identity	The fishers' perceived role in relation to the management system
	Learning	The fishers' interpretation of the management system and dialogues with the management regarding the discards Individual and collective initiatives to learn
State	Regulations and measurements	Input/output regulation Technical measures
	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

### *Applying the list in case studies*

The list of factors influencing discard behaviour has been used as a check list for a study of fishers' interpretation and behaviour in regard to discard in three trawl fisheries cases in Denmark, Greece and United Kingdom. In the same process the relevance of the specific factors of the list were tested.

The case studies were based on desk study and semi-structured interview. Several factual data are normally available in a desk study; the natural condition for the specific fishery, the methods and elements of regulation of the fishery, the general market conditions of the fishery and the composition of the fleet. To some extent behaviour has also been documented; registered discards, compliance, general use of gear and fishing places as well as information on local history, organisations etc. But other behavioural elements as well as the fishers' interpretation of discard and the various factors (which again influence behaviour) can best be studied by qualitative methods. In the Danish and Greek cases semi-structured personal interviews were used, while descriptions from interviews conducted in 2009 was used in the English cases. During the interview visit observations of behaviour and attributes were also noticed as input for the interpretation of the interviews (Schein 2004).

The semi-structured interviews were conducted in a way that on one hand balances openness to the informant's associations/answers and on the other hand an agenda for the overall topics of the interview, based on Bernard's ideas for semi-structured interviews (Bernard 1995) and Kvale's writings on dynamic, positive interaction (Kvale 2004). The personal interview was followed by an evaluation, considering if the interview provided new information (concepts, reasoning etc.) and new perspectives and if crucial information could be questioned in later interviews. Most interview persons were contacted for checking the interpretation of the interview and getting any supplementing information. The interview persons were not chosen to be representative in a statistical sense (Kvale 2004; Wadel 1991; Spradley 1980). The first interviewed persons have been strategically chosen from relevance in regard to the chosen fishery (location, gear and target species). Often the local chairmen of the fisheries associations pointed at other possible interview persons. The actual persons were chosen in order to broaden any further perspectives on the themes. The interview lasted 1-2 hours and took place in a fishing locality chosen by the fisher (facilities in the port, at the vessel or in some cases private) in order to get as close to the fishing environment as possible. The methodology was designed for departing from the everyday practice, especially discard practice, which then could be compared to official discard data. This turned out to be impossible due to a four-year time lack of official discard data, which then was useless in fisheries with ongoing changes in regulation and therefore in the fishing practice and discard pattern.

### *The cases studies*

Three case studies have been conducted; Danish nephrops trawlers in Kattegat, Greek trawlers in mixed fishery in the Ionian and Aegean Seas and in United Kingdom three fisheries; Prawn Fishers in NW England, Nephrops trawlers in NE England and Beam trawlers of Devon, South West England (Corporate Culture 2010, McArthur & Howick 2010 and Corporate Culture 2009 and Eliassen et al. 2012 - for description of the three case studies).

The Danish case covers the nephrops trawl fishers in Kattegat. The fleet consists of minor trawlers: side- and stern trawlers of 10-18 metres with 1-4 crew members including the skipper. The trawlers often also hold quota for the neighbouring sea areas, Skagerrak and the Baltic Sea. The fishery is mixed with nephrops as the dominant species and sole, plaice and turbot as other important species. The traditional target species, cod, today only contributes with 1 % of the Kattegat landing value. The Kattegat fishery is regulated by quota on most species: MLS, effort regulations as limited days-at-sea and closed areas as well as gear regulations on mesh sizes and special trawls with panels, windows, grids etc. An experiment proposed by the fishers of pure effort regulation in Kattegat was close to being accepted in 2005, but was given up when a national system of Vessel Transferable Quotas (an ITQ-like system) was introduced in 2007. The cod recovery plan of Kattegat has put the days-at-sea under hard pressure (as they are supposed to be reduced if the cod is not recovering). In 2008 a group of nephrops fishers attempted without luck to document low catch and discard of cod in a project of "Selective behaviour" and thereby avoid reduction in effort. In order to avoid reduction (and soon closure) of the Kattegat fishery the Danish Ministry has documented alternative measures in closed areas, obligatory use of selective trawl and fishing pools. The catches are mainly sold via a few larger auctions. A large part of the nephrops catches are processed by a few local processing industries and therefore important to employment and economy in several local communities. The discard data for 1998-2008 shows a 50 % discard in weight (and considerable higher in numbers). The main discard is nephrops under MLS, with cod and saithe as the next highest volume. The discard seems to be mainly under MLS catch, though the discard from saithe could be related to lack of quota. There have been important changes in the regulation after 2008, which according to fishers and research indicates a lower discard level today. Despite of a high discard, the nephrops stock seems very healthy. The fishers accept a regulation system and have been active in shaping it by formulating alternative regulations as mentioned above. Newer the less they generally feel stigmatised by cheaters in the public. Many have experienced cooperating with science in research fisheries or gear tests and use terms from science in describing their understanding of species interaction. Some even refer to agricultural terms of maintaining the good bottom for the nephrops by continual trawling and feeding the nephrops with discarded material. Explicitly on discard the fishers generally only sees discard of commercial species as a problem. There are various approaches to the problem; as an ecological problem some discard can be seen as feeding the target species, whereas discard of some species is seen as a result of uneven fishery pressure (e.g. closing of industrial fisheries). In economic terms discard of marketable fish was not seen as a problem, whereas it is good economic sense to discard non-commercial species. The most important discard problem seen from the fishers' perspective is the political focus and the risk of a total discard ban. The fishers feel that they have been marginalised in the large society, and other sectors gain importance in their local communities. In relation to the general public view on fishers they feel stigmatised as cheaters. They claim reluctant to new initiatives, which they expect to be used against them. Nevertheless, in practice they show an increasing use of scientific phrases and do cooperate in scientific fishery and gear development.

The Greek case covers trawlers in mixed fishery fishing from eight major ports in the Ionian and Aegean Seas. The trawlers were over 12 metres of length. For the whole trawler group the average number of crew are around 7 for the Aegean Sea and 5 for the Ionian Sea, often a Greek skipper and Egyptians crew men. The trawlers are doing a mixed fishery with hake as the most important species. The Greek trawl fishery is regulated by effort and closed areas, both permanent and temporary, minimum landing size (MLS) and gear regulations. A 40 square mesh trawl has recently been introduced. There is no TAC or quota regulation, but trawlers are prohibited to land species as sardine and anchovy. The discard rates in weight are highly fluctuant in the Ionian Sea; registered to be between 70 % and 16 % in 2003-2008, while more stable around 35 % in the Aegean Sea. The compliance of the Greek fishermen to the national and EU regulations is generally loose, especially regarding the MLS, as the authorities has huge difficulties in monitoring the numerous fishing vessels in remote fishing grounds and to impose the regulations. There is a considerable marked for small fish, also below the minimum landing sizes, apparently for the local fish mongers or restaurants. The discard of marketable fish under MLS seems to be low, whereas the most important fraction of discard is non-commercial species.

The fishers generally accept a regulation system; though they do not agree on all regulations. Many have participated in scientific or research fisheries and they seem to be able to arrange trade-offs with authorities; i.e. more closed months should be followed by more open areas or subsidies. At the same time they fear harder measures without compensations. Based on their daily experiences and biological arguments they have developed understandings of species interaction, what influences the fishing opportunities etc., which can be heard in discussions of themes as discard, interaction with other fishers etc. The fishers sees discard as an unavoidable part of the fishing practice in the mixed fishery. The trawl fishers feel that they are rough-handled and portrayed as responsible for overfishes stocks, while the coastal fishers are seen as more traditional low impact, low income fishers.

The English case covers three trawl fisheries; prawn fishers in NW England, Prawn fishers in NE England and beam trawlers of Devon focussing on sole. As the case is based on desk research of studies of discard attitudes there's no detailed description of the fisheries.

Most of the fishers saw discard as a problem in moral terms, hard work to do and a potential danger of ecology and future economy. The fishers distinguish between discard of non-commercial species, juveniles and over-quota discard. The first two should be avoided as it is hard work to discard and discard of juveniles can endanger the stock. These are in some situations attempted to avoid by going to other fishing places and other fishing practices.

For the over-quota discard the fishers see regulation as the problem. There is transferability of quota for vessels over 12 metres (mainly within the Producer Organisations). If the problem was the quota composition at the individual vessel transferability could reduce the quota related discard. But the fishers claim there is a basic mismatch between total quota and the real amount of fish. Further there they are reluctant to invest in quota shares, which might be reduced in catch value next year. Especially one of the fisheries discarded over MLS fish because of catch composition rules, which lead to discard of fish they had quota for, if it was caught in another mix.

In the three fisheries the fishers in general feel marginalised; one group expressed it as under pressure of still harder regulation, another as being seen as criminals although in reality a part of

an ancient and innocent tradition of food and jobs to communities. The third group did not feel a specific pressure, they were rather to be forgotten and with low public attention.

Looking across the cases factors from all four main areas; natural conditions as well as community, state/regulative and market clearly had important influence at the discard level and pattern. It was clear from the interviews and supported by other sources. The differences in the importance of the specific factors and not least their interrelation is of more interest.

It is obvious that there is no common definition of what is the discard problem. There is not necessarily fully accordance between the fishers, not even within each case. But they also do not know 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 as politicians and greens. A common understanding of what is the discard problem – or at least clarity of the positions – is probably a precondition for cooperation towards reduction of discards.

There are some discrepancies within the fisher groups on the definition of discard problem. But the market conditions are generally decisive for what is the discard problem; 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 the minimum landing sizes. The discard of individuals of commercial species but too small to be marketed is also often seen as a problem, thus for the future fishery. The fishers' views of the rest of the discard fractions in an ecological perspective are more complex; some are worried about this but less about the consequences of other fishery activities, pollution from land or sea, invasive species etc. Others 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 of the English and Danish cases have taken initiatives to develop new regulation tools as well as new gear also with higher selectivity, while the same initiatives have not been reported from Greece. The explanation is probably mainly the political and managerial focus on discard. While there is limited focus on discard in Greece it is an important political issue in England and Denmark and an important element in recovering plans in these two countries. Among other things by addressing bycatch and discard the fishers try to avoid the regulative measures which can treat their fishery.

Looking across the cases finally illustrate that the effect of one factor often depends on the interrelation to 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, though at an unclear and most likely lower level than registered, as more selective trawls have been enforced after the last year with available data. 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. There was a low 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 in an easy way allows fishers 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 another catch composition. 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 accept 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 quotas 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 developing measures make both the final outcome and transferability of measures unpredictable. A specific measure in isolation tends to create a certain incentive. But other factors can strengthen the incentive or counteract it. In pre-assessments (or evaluations) the whole range should be included.

### *Evaluation of the list of factors influencing discard behaviour*

We have developed a list of factors which can drive the discard behaviour of the individual fisher. 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 and framework for behaviour. The behaviour can point in different directions, 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. In evaluating the list it is important to stress that the specific factors of the list have had various importance in the selected cases. Some has not been seen as an influential factor. As the cases are not representative for all fisheries, they might influence other cases (not studied here) or might even just need other more anthropological methods to be identified as influential. Therefore the list could 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 could eventually have developed the importance of e.g. weather conditions, which were hardly mentioned. Based on the present data we cannot say if this would be more than a marginal factor.

The community factors played important though more intangible roles in the cases. As mentioned the norms regarding discards 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 of 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 they could be there, but hidden to an 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 this relation revealed that no fishers saw themselves totally in opposition to the management system. Those seeing themselves as real partners to the authorities had an expectation of being able to make



agreements on certain measurements that the fishers would follow and evaluate before new were introduced. They were often disappointed due to a flow of new measures. The learning factor could lead to higher or lower discard level – depending of what learning and knowledge are focused at. 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 science and forms a possible basis for dialogue on discard issues. At 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 to avoid certain types of bycatch and discard. No such initiatives were reported from Greece.

The state factors focus on the formal institutional structures as well as the interpretation of these. Clearly the choice of input or output regulation influences (no quota related discard in input system) as well as technical measures influences discard pattern; 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 discards. 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, when 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 discards (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 auction (or other market) prices are of importance, also the risk related to strong fluctuating prices and not least costs. 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. However, it is not clear how important the interpretation of risk and indirect costs is for the discard behaviour. Surprisingly the market pressure for certified fish eventually caught under low discard was not mentioned in the cases as a factor behind changed behaviour. 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. Some fishers even declared that in order to limit sorting time and effort they preferred some areas with less unwanted bycatch. The cases tend to point at own experiences and sharing of experiences within the group as a more important tool to identify areas with lower bycatch than tracing equipment.

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 attempts 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.

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