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The influence of human rationality and behaviour on fish quality

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ABSTRACT

This paper discusses the role of human rationality and behaviour with respect to perceptions of fish quality by exploring two intriguing observations of the sale of fresh cod and haddock from the Norwegian coastal fishing fleet to local fish buyers: (1) fish of poor quality is sold at too high a price and (2) catches from the coastal fleet based on long line/hooks, which provides the fish of the best quality, are in decline. These two phenomena are analysed by scrutinising the minimum price system, the power and dependency relationships between fishermen and fish buyers, the use of power by fishermen and fish buyers when negotiating prices and the transaction costs involved in evaluating fish quality. The results show that the first-hand sale of fresh cod and haddock suffers from several market imperfections, which help explain why fish of poor quality gains good prices and why coastal long lining is in decline. We argue that the behaviour of both fishermen and fish buyers represents "social dilemmas" where seemingly rational individual behaviours lead to a situation where everyone is worse off than they otherwise would have been. This article also discusses suggestions for solving these social dilemmas.

1. Introduction

Fish quality is an important research topic for several reasons. As fish is a highly perishable foodstuff, it will quickly deteriorate if it is not handled, processed and stored appropriately. Fish of high quality also provides consumers with top-level food experiences, for instance by eating raw fish where only the very best quality will suffice. On the other hand, there is a close link between quality and seafood safety, as fish of poor quality may represent a serious threat to consumers' health and well-being. For fishermen and the fish processing industry, fish quality is important because it relates to their reputation and the prices they obtain. From an ethical point of view, it can also be argued that fish harvesting and processing should always strive to optimise fish quality so that renewable, albeit limited, fish resources are not wasted.

The importance of fish quality is reflected in a substantial research effort devoted to improving and retaining fish quality throughout the value chain. A range of scientific journals cover various aspects of fish quality (e.g. Fisheries Research; Journal of Aquatic Food Product Technology; Review in Fisheries; Food, Quality and Preference). A central tenet in this research is to improve technology and handling practices in order to optimise and preserve fish quality. For Atlantic cod, for instance, different fishing gear has been found to influence fish quality in different ways (Esaiassen et al., 2013), the quality consequences of (poor) bleeding of fish has been documented (Olsen et al., submitted for publication), and the influence of different packaging technologies on product quality has been examined (Hansen et al., 2007).

The research on fish quality has undoubtedly been important in improving the current understanding of factors affecting fish quality and improved technology is continuously developed. However, the same literature seems to assume implicitly that humans involved will act "rationally", i.e. will always adopt the best available technology and handling practices in order to ensure high quality fish. Our research, reported below, suggests that this may not always be the case. We base our discussion on two intriguing observations of Norwegian small-boat fishermen and the primary processors who buy their catches, where what appears as "non-rational" human behaviour results in fishing and handling practices that do not always optimise fish quality. More specifically, scientists observed that fish buyers often purchased fish of poor quality at high prices, leading to economic losses by processing plants. We also observed that catches based on long line/hooks, which provides fish of the best quality (Rotabakk et al., 2011), are in decline compared to landings from other types of coastal fishing gear such as Danish seine and gillnet (Henriksen and Svorken, 2011). We label these two observations as market failures because fishermen and managers of processing plants behaved differently than one would be expect under ideal conditions in a perfectly competitive market (e.g., Pindyck and Rubinfeld, 2001). By exploring the causes of these

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market failures, we were able to shed light on several interesting research questions. For example, how is it possible that processing plants are willing to buy poor quality fish at prices that lead to loss of profit? Why is coastal long lining, which delivers the best quality fish, in decline? In addition, what are the long-term consequences of these phenomena?

Below we report the study designed to explore these questions. The following section describes the research design and data collection methods. The results section starts by documenting the two observations described briefly above. We then explore several conditions that may explain the market failures. These include the potential impact of the minimum price system; power and dependency relationships between fishermen and fish buyers; the actual use of power by fishermen and fish buyers and transaction costs. Finally, we discuss the findings and implications highlighted.

2. Research method and data

We used several different sources of data to explore the research questions.. Firstly, we conducted in-depth interviews with fishermen, fish buyers and the managers of fish exporting firms. We interviewed a number of fishermen representing different types of fishing methods, such as long line, gillnet and Danish seine. The fish buyers interviewed purchased fresh cod and haddock from the coastal fleet and either packed the fish fresh (headed and gutted) for European markets or produced various types of fresh and frozen fillet products for export. The interviews also included the largest Norwegian exporters of fresh cod and haddock.

Interview guides were developed prior to the interviews. Key topics for the interviews with the fishermen were the quality of their catch, the price–quality relationship, the functioning of the first-hand market, dependency and nature of their relationship to local fish buyers. The interviews with the fish buyers focused on quality and fishing method, the price–quality relationship, the functioning of the first-hand market, and their dependency on and relationship to the fishermen. The interviews with the exporters mainly focused on whether the type of fishing method was perceived as important by their downstream customers (typically European wholesalers) – and, if so, why. The interviews were conducted as informal conversations, with emphasis on letting the subjects play the active role. The interviewer followed up with probing questions in order to gain a deeper understanding of the interviewees' perspective. When we reached a point where new interviews gave little new insights into our research questions, we concluded the study (Eisenhardt, 1989).

The two authors conducted the interviews together. We conducted most of the interviews face-to-face at the respondent's premises, while others were conducted by telephone. The authors compared notes taken during the interviews and prepared a full transcript from each interview as soon as possible after the interview, and normally the same day. The interview transcripts were content-analysed by identifying and comparing the subjects' perception of the key issues covered during the interviews. To allow the reader to assess our interpretations and conclusions, we report excerpts from the interviews (Kirk and Miller, 1986).

The study also utilised secondary data based on the contract note,[1] which contains the price, fishing method and other relevant information for every single transaction between fishermen and fish buyers. In addition, the authors also used data on Norwegian exports of various products based on fresh cod and haddock. Another source of data was the trade newspaper "FiskeribladetFiskaren", where a range of articles have focused on various aspects of coastal long lining, first-hand sales of cod and haddock, the minimum price system, fish quality and marketing. The authors also studied web-based debates following many of these articles on the newspaper's website (http://fiskeribladetfiskaren.no).

By utilising several sources of data to explore the same research questions, the aim was to gain additional insights and increase the reliability of the study and conclusions (Jick, 1979). In order to guide our research and to interpret and analyse the results, we exploited several different types of research literature. This included theory on power and dependency; transaction cost analysis; social dilemmas; buyer–seller relations, and microeconomics. This multidisciplinary approach was useful owing to the complexity of the phenomena under scrutiny.

3. Results

The interviews with fishers and fish buyers showed that poor quality is common across different fishing methods, but long line and hand line/jigs generally obtained the best quality fish. Some of the fishers interviewed admitted that they frequently delivered catches of poor quality. They explained that they did what was most effective in terms of maximising catch per effort and that this was not beneficial to fish quality. However, they received good prices so they did not see the need to improve the quality. One of the fishers who admitted to delivering poor quality fish told us: "We gain the same price as the others anyway". Frustrated fishers also told us that they had regularly seen catches of poor quality fish receiving the same price as their own high quality catches delivered to the same plant at the same time.

Several fish buyers told us that they frequently paid too high a price for poor quality fish. One of them presented a revealing estimate of profit margins for filet production based on fresh cod and haddock of variable quality (Henriksen et al., 2010). His calculation included three quality levels where the best quality was fish that yielded fillets without gaping, a key quality problem for the filleting industry (Akse et al., 2005). The second best quality comprised fillets with some gaping and the inferior quality fillets with extensive gaping. Table 1 shows profit margins for three different types of production mix based on raw materials of high, medium and poor quality. Table 1 shows that the fish buyer achieved the highest positive margin for a mix of cod loins and blocks based on high quality raw material with a positive margin of NOK 16.49 per kilo. This stands in strong contrast to a negative margin of NOK 12.00 per kilo for the same product mix based on poor raw material. The fish buyer paid the same price (minimum price) for all three qualities (NOK 17 per kg), implying that he paid too high a price for the poor quality raw material, which contributed to the negative economic result.

Table 1 also shows that the differences in margins for haddock products are substantial depending on the quality of the raw material. Interestingly, the raw material price paid for the poorest quality haddock was about 32% lower than the price paid for the best raw material. The price paid for the poorest quality (NOK 7.5 per kg) was the actual minimum price, whereas the price for the best quality (NOK 11 per kg) was above the set minimum price for haddock caught with hook and line. Thus, in spite of a substantially

Table 1
Estimated margins (NOK/kg) for three key types of product mixes based on raw material of three different qualities (Henriksen et al., 2010).

	High quality	Medium quality	Poor quality
Whole haddock fillets	5.83	0.81	−4.07
Haddock loins and blocks	9.62	4.79	−2.93
Cod loins and blocks	16.49	−3.08	−12.00

[1] Decreed by Norwegian law with primary purpose to conduct resource control.

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lower raw material cost, the fish of inferior quality leads to a loss of profit, indicating that the raw material, even at reduced price, was too expensive.

Although fish quality varies within catch methods (Akse et al., 2004), the informants, including fish buyers and Norwegian fish exporters, all agreed that fresh cod and haddock from coastal long liners were the best fish available. They all seemed to agree that fish from gillnet and Danish seine could be of equally good quality, but also that this is seldom the case. According to the exporters, this instability in quality is a key problem for downstream buyers because they are uncertain as to what they will get – in contrast to when they buy line-caught fish. This implies a strong preference for line-caught fish, which during some periods of the year can obtain a price premium over fish caught by other methods. During other periods of the year, when supply is plentiful, line-caught fish does not necessarily gain a price premium, but it is the easiest fish to sell, implying reduced transaction costs for both Norwegian exporters and their customers.

In spite of the apparently positive reputation for high quality in the market, coastal long lining is losing ground compared to other fishing methods. Fig. 1 shows the share of the total catch for line-caught cod and haddock. Fig. 1 shows that long liners have had a stable share of the total catch of cod for the last decade or so, but for haddock, the share has dropped markedly.

Part of the explanation for the decline in line-caught haddock is probably that long lining is a fishing method that is less effective than gillnet and Danish seine, i.e. each line boat incurs higher costs to catch the same quantity compared to boats using gillnet or Danish seine. The variable costs, and in particular the costs of the bait and getting the line baited, are substantial for long lining compared to gillnet and Danish seine. Finally, prices achieved for line-caught cod and haddock seemingly do not compensate fully for the extra effort and costs involved. All the long liners interviewed were dissatisfied with the prices they achieved. One remarked that if prices did not rise within two years he would change to gillnets. Several of the fish buyers admitted that they frequently paid too low a price for line-caught cod and haddock.

3.1. The minimum price system

Pursuant to the Raw Fish Act, minimum prices for fish sold by Norwegian fishing boats are set through negotiations between The Norwegian Fishermen's Sales Organisation and fish buyers' organisations. The intentions of the minimum price are to secure the fishermen a price that reflects market prices and to avoid powerful

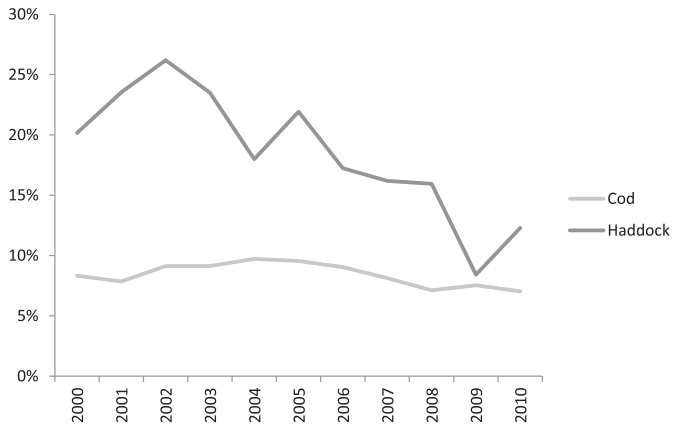

Fig. 1. Percentage share (*Y*-axis) for line-caught cod and haddock of the total Norwegian catch of these species from 2000 to 2010 (*X*-axis).
Source: The Norwegian Directorate of Fisheries

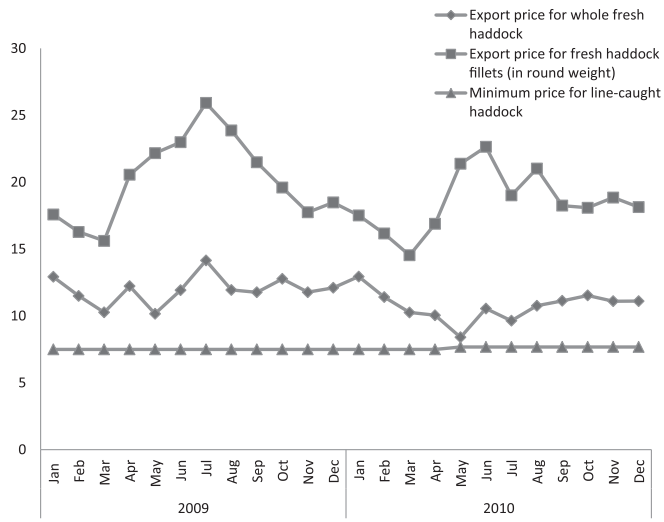

Fig. 2. Minimum prices (NOK/kg) for fishermen for haddock and monthly average export prices for fresh whole haddock and haddock filets (in round weight equivalents).
Sources: Norwegian Seafood Export Council, The Norwegian Fishermen's Sales Organisation

fish buyers using their bargaining power to set prices that are too low for small independent fishermen. According to The Norwegian Fishermen's Sales Organisation, it is possible to reduce the minimum price by up to 40% if the quality is poor (The Norwegian Fishermen's Sales Organisation, 2013). This, however, assumes that a reduction in price can only be implemented by agreement between the fisherman and fish buyer (The Norwegian Fishermen's Sales Organisation, 2013). Importantly, fish buyers are free to pay more than the minimum price. This implies that the Raw Fish Act does not hinder a buyer from paying a low price for poor quality and a high price for good quality. Currently, there is also a specific minimum price for large haddock (>0.8 kg headed and gutted weight) caught by hook and line, which is 27% above the price for large haddock caught by other fishing methods. These aspects of the minimum price system are positive in the sense that they provide sufficient opportunity for agreement of a "correct" price between fishermen and fish buyers. In other words, that fish of poor quality obtains a low price and fish of high quality achieves a high price.

There is no specific minimum price for cod caught by hook and line. Currently (autumn 2013) the minimum price for headed and gutted cod over 6 kg is NOK 13.25, whereas the price for the category 2.5–6 kg is NOK 10.50 (The Norwegian Fishermen's Sales Organisation, 2013). As cod caught by long line are usually somewhat smaller than cod caught by gillnet (Henriksen, 2006), long liners receive less income from their cod quota than boats fishing with gillnet. For similar reasons, the profitability of the long liners is reduced compared to boats fishing with gillnet, assuming that the price is the same.

The minimum price is usually negotiated three times a year (May, September and December), implying that it is stable for relatively long periods. Fig. 2 compares the minimum price for haddock with the Norwegian export prices for whole fresh haddock and haddock fillets (in round weight equivalents) for 2009 and 2010.

Fig. 2 shows that market prices vary substantially throughout the year and much more than the minimum price. The same pattern occurs for cod as well. When market prices drop substantially, this reduces the fish buyers' margins because the minimum price is fixed and does not follow the price reductions in the

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market. One way to circumvent the minimum price is for the fish buyers to claim quality reductions in order to reduce the price to better match low market prices. Fig. 3 shows the share of downgraded cod and haddock for the months March, April, May and June from 2008 to 2010. Quality downgrading was rarely applied during the other months of the year.

Fig. 3 clearly shows that fish buyers frequently applied quality downgrading during the spring of 2009. There is no reason to believe that the quality of the fish was poorer in 2009 than in 2008 and 2010. However, in 2009, the effects of the financial crisis hit important seafood markets with falling demand and prices (Dreyer and Bendiksen, 2010). The observations in Fig. 3 also correspond well with the findings by the Norwegian Directorate of Fisheries. During the spring of 2009, inspectors revealed that fish buyers applied quality downgrading without objective reasons (The Norwegian Directorate of Fisheries, 2009). This indicates that quality downgrading functions primarily as a "tool" to reduce the minimum price when it is set too high – or is changed too slowly – compared to the prices the fish buyers can charge to their downstream buyers. The use of quality downgrading to reduce price (without quality being poor) has also been observed in the stockfish branch of the Norwegian seafood industry (Korneliussen et al., 2007).

3.2. Power and dependence

In line with the "open systems" perspective (Scott, 2002), fishermen depend on someone to purchase their catches so that they can pay for fuel, fishing gear, crew and other input factors. Fish buyers depend on raw material for their production in addition to a competent workforce, production facilities, capital and so on. Consequently, fishermen and fish buyers are mutually dependent on each other to stay in business. This mutual dependence influences the power balance between fishermen and fish buyers because dependence is inversely proportional to power (Emerson, 1962). In other words, a fish buyer highly dependent on fishermen has, in principle, little power over the fishermen and vice versa. A range of different conditions/factors influences the dependency and power balance between fishermen and fish buyers. Table 2 shows conditions that increase (+) or reduce (–) the power of fishermen and fish buyers, as identified through the fieldwork.

Due to high capital costs and a need to prevent skilled workers from leaving, it is crucial for fish buyers to keep their processing plants operating. Many local fish buyers have high capital costs and few skilled workers available, which makes the fish buyers highly dependent on sufficient and regular supplies of fish. Nevertheless, when fish are abundant, which usually happens during the winter (January to April) for cod, there are many boats operating and large quantities of cod available. This situation shifts power over to the fish buyers, especially for the buyers adjacent to the best fishing grounds. In periods of short supply, fish buyers often pay over the minimum price, even for fish of poor quality.

The fishermen's dependency on fish buyers varies depending on the size of their vessel and its mobility. While small coastal vessels usually fish from a home port, the larger vessels are more mobile and can move between different ports according to where the price (and other conditions) is most favourable. This increases the bargaining power of the larger vessels, while small boats that depend on one local fish buyer are in a less favourable bargaining position.

For coastal long liners, the dependency on a home port is particularly strong because they require a base where they can have their lines baited. The larger coastal vessels also deliver larger quantities of fish, which means that they are valuable suppliers. This is particularly true in periods when supplies are generally low (summer and autumn). In addition, large catches imply reduced transaction costs in comparison to the smaller catches from smaller vessels.

Many fish buyers offer various types of services to fishermen, such as bait sheds, overnight accommodation, loans and so on (Ottesen and Grønhaug, 2003). The fish buyers estimated the cost of their services to long liners to be NOK 1–1.50 per kilo fish bought. This increases the fishermen's dependency on the buyers.

Some fish buyers have experienced that fishermen can be more loyal to each other than to the fish buyers. One example cited by a frustrated fish buyer was the consequences of quality downgrading. He told us that if he reduced the price of a poor quality catch, the news spread rapidly among fishermen and it often resulted in a collective boycott. Consequently, the fish buyer ended up paying too high a price for catches of poor quality. An important point was that such threats could persist for a long time. For example, quality downgrading of haddock from a large coastal vessel in spring could lead to a boycott in autumn, when supplies in this area are low and the need for fish to keep the factory operating is high.

In principle, one would think that long liners and jig fishermen, who usually deliver the best quality fish, have a favourable bargaining position vis-à-vis the fish buyer. After all, the fish they deliver provides the highest proportion of the most profitable products (i.e. fresh loin). However, several factors contribute to reduce this advantage. Firstly, the coastal long liners are usually small, implying relatively small catch sizes. In addition, they are "unreliable" suppliers because they depend on good weather conditions to be able to fish. Many small long liners also change to gillnets or targeting other fish species (than cod and haddock) when economically advantageous. For example, many line boats have in recent years changed from fishing haddock with long line to targeting monkfish with gillnets in autumn. Fishing for monkfish with gillnets is appealing as it demands little work (only two days a week at sea) and because monkfish commands premium prices, resulting in high profits for the fishermen. However, the presence of

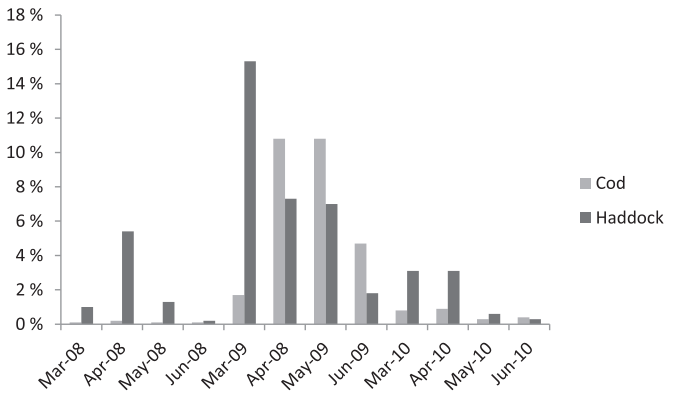

Fig. 3. Share of downgraded cod and haddock during March, April, May and June for 2008–2010.
Source: The Norwegian Fishermen's Sales Organisation

Table 2
Principle sources of power for fishermen and fish buyers.

	Fishermen	Fish buyer
Sources of power	Offer large quantity (+) Offer high quality (+) Small total supply (+) High mobility (+) More than one local buyer (+) Social relations with buyers (–) Receive services from buyer (–)	The only local buyer (+) Large total supply (+) High capital costs (–)

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up to 500 nets per monkfish boat results in restricted access to the best fishing grounds for long liners.

These factors result in unstable supplies, which make it difficult for fish buyers to plan their production and to negotiate good sales contracts in the market. This in turn reduces the bargaining power of the small coastal vessels.

Many small coastal vessels operate from small ports where there is only one fish buyer. Everyone knows each other, which contributes to social obligations and loyalty between fishermen and fish buyers. When supply is abundant, the local fleet is often preferred over boats coming from other areas. Conversely, the low mobility and loyalty to a home port makes small vessels heavily dependent on their local fish buyer.

3.3. Use of power

The fieldwork indicates that coercive use of power is typical in price negotiations. When the power balance shifts towards the fish buyers, they will use power to make fishermen supply fish of high quality at a lower price. A good example of this occurred during the winter season of 2009, when the financial crisis hit and market conditions became very difficult during a period when quotas were high. The fish buyers used the attained bargaining power to demand higher quality and squeeze prices. Some buyers refused to buy fish from boats using gillnets and prohibited their regular boats from changing from long line to gillnet, which is common practice when the cod fishing is at its best during the winter season.

The result was a substantial reduction in the share of cod caught by gillnet from 2008 to 2009. In addition, fish buyers frequently downgraded the quality of fish as shown in Fig. 3. However, as discussed above, fishermen will also use their bargaining power, when the conditions are right, to keep the prices high even when the fish is of poor quality.

There are, however, examples of less coercive relationships between fishermen and fish buyers. As part of our fieldwork, we followed the development of a cooperative relationship between a fisherman and a fish buyer from its start up to its end after about two years. From the start, it was evident that the relationship was beneficial for both the fisherman and the fish buyer. Nevertheless, both parties had to make sacrifices and commit to the relationship. Table 3 lists the advantages and commitments involved in the relationship.

The key benefit for the fish buyer was that “locking in” a fishing boat was a guarantee of delivery of quite a substantial quantity of high quality raw material. For the fish buyer, this was important to keep the wheels running in the filleting plant throughout the year. In addition, it made it easier to fulfil sales contracts with customers in the market. The cost of these benefits was a higher price to the fisherman. In addition to a high price, the key benefit for the fisherman was that the boat could deliver the catch un-gutted, but properly bled and chilled. This meant that the fisherman could concentrate on optimal utilisation of the boat’s catching capacity for haddock.

Table 3
Advantages and obligations in the relationship between a fisherman and a fish buyer.

	Fish buyer	Fisherman
Advantages	- Secures access to high quality fish - Timely delivery of catch	- Good price - No onboard gutting - Optimal utilisation of catch capacity
Obligations	- High prices - On plant gutting of catch - Buy the whole catch	- Must deliver all fish to buyer - Deliver catch at specific time of day

In the beginning, the relationship appeared to function well. However, as time progressed, the fish buyer reduced the price several times. Importantly, the cooperation started at a time of the year (summer) when prices were generally high due to low supply and high market demand. When supply increased in autumn and winter, it became difficult for the fish buyer to retain the price to the fisherman at the same level. However, when the fish buyer reduced the price, it came as a surprise and frustrated the fisherman, indicating that communication from the fish buyer regarding anticipated market developments could have been better. Over time, the fisherman also became frustrated due to a lack of feedback regarding the quality of the catch. This was frustrating because the fisherman was concerned about the quality, especially relating to any gaping problems that might be due to the different onboard handling and chilling procedures. In the end, the fisherman left the relationship for another fish buyer offering a better price. The new relationship was based on more or less the same advantages and obligations as those shown in Table 3. Thus far, extensive communication from the fish buyer regarding quality and market developments (influencing future price movements) seems to favour a longer lasting relationship.

3.4. Transaction costs

As noted above, the price may be reduced by up to 40% due to poor quality. It is, however, required that the fisherman and fish buyer agree on this (The Norwegian Fishermen’s Sales Organisation, 2013). It might be very challenging for a fisherman and a fish buyer to agree on the quality of a catch. This is because fish quality is an elusive and multifaceted concept (Anderson and Anderson, 1991) where different opinions are likely to prevail. In addition, both parties have substantial, but conflicting, economic interests in the outcome.

Paradoxically, it can also be difficult and costly for fish buyers to reward the fishermen who deliver the best quality fish with a high price. This is because doing so may lead to a general expectation among fishermen of a higher price for all. This in turn, may lead to conflicts between the fish buyer and fishermen. It can also lead to conflict between fishermen utilising different fishing methods.

If the fish buyer has to negotiate with each fisherman on the quality of every catch, the transaction costs become significant, particularly during periods when numerous vessels deliver relatively small catches. This probably explains why many fish buyers set a single price for all fishermen independent of quality or fishing method. This, however, will primarily benefit those who deliver poor quality, while leading to substantial frustration among the smaller vessels who deliver high quality fish. However, as discussed above, these small vessels do not necessarily hold a strong position when bargaining for higher prices.

The Norwegian coastal fishery for Atlantic cod is characterised by substantial seasonal variations (Ottesen and Grønhaug, 2003; Dreyer and Grønhaug, 2004; Hermansen and Dreyer, 2010). Around 90% of the annual catch (for vessels less than 28 m long) of cod is landed during the first six months of the year (Henriksen, 2011). This implies a substantial challenge for processing firms in terms of their capacity utilisation (Dreyer and Grønhaug, 2004). During the peak season, the production capacity is utilised to its full potential in order to process the large quantities of cod landed. In this period, many processing firms will have a strong focus on producing the fish as fast as possible in order to avoid quality loss. In this situation, they will often not keep line-caught fish separate from fish caught with gillnet/Danish seine, thus mixing all catches in production. This is understandable because line caught fish accounts for a relatively small share of total landings in this period. However, it also means that the fish buyers miss the possibility to

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gain a better price for the line-caught fish, which in turn makes it difficult for them to pay a premium for the line-caught fish.

4. Discussion

This paper contributes to the current understanding of factors influencing fish quality by exploring the role of human rationality and behaviour, which is a neglected area of research in the fish quality literature. More specifically, we show that the first-hand sale of fresh cod and haddock in Norway suffers from several market imperfections. These imperfections help explain why fresh cod and haddock of poor quality gain good prices and why the line-caught fish of the best quality does not gain the high prices it probably deserves. The results also go some way to explaining why coastal long lining is in decline.

When a fisherman uses bargaining power to gain a high price for poor quality fish, it is rational in the sense that the fisherman gains a good price for the catch and can continue with practices leading to poor quality. The problem with this is that the fish buyer loses money, but accepts the price for fear of losing supplies in periods of the year when low supply may lead to idle production facilities. In the end, this has several consequences that are undesirable for any of the parties involved, including the fisherman. Firstly, over time and through repeated unprofitable purchases, the fish buyers' profitability will be reduced. This may eventually lead to bankruptcy, which means that the fisherman loses one out of an already limited number of fish buyers, increasing the fisherman's dependency on the remaining fish buyers. Fish buyers who remain in business with reduced profitability will not be in a position to pay higher prices for good quality. Moreover, poor and unstable quality is not highly valued in key export markets (Heide and Henriksen, 2013).

When the fish buyer uses his or her bargaining power to pay a low price for the best quality fish (usually line-caught fish), it is rational in the short term. Nevertheless, when several fish buyers do this over time, it leads to low profitability for the coastal long liners. This contributes to changes in fishing method where long liners typically change to gillnet or Danish seine. These methods have higher catch rates implying a shorter time to catch the cod quota with lower costs than long line. The problem here is that line-caught cod and haddock is the best fish the market can get and it contributes to a positive reputation for the Norwegian whitefish industry (Sogn-Grundvåg and Henriksen, 2011). A recent econometric study of chilled pre-packed cod and haddock in seven UK supermarkets showed that the attribute "line-caught" gives cod and haddock a price premium of 18% and 10% respectively (Sogn-Grundvåg et al., 2013). Although line-caught cod and haddock were only sold in three out of the seven supermarkets investigated, this indicates that at least some market segments value high quality fish. It also indicates that if the quantity of line-caught fish continues to fall, the whitefish industry misses an important opportunity for niche marketing and value adding.

The described behaviour of both fishermen and fish buyers represents "social dilemmas", i.e. situations where seemingly rational individual behaviours leads to a situation where everyone is worse off than they otherwise would have been (Kollock, 1998). Social dilemmas are difficult to solve. However, it would be wise if the parties involved tried to understand the social dilemmas of which they are part. This includes their role and whether it would be sensible to change their behaviour in order to improve their prospects of achieving success in the future, as well as the prospects of others. For example, it could be useful for both fishermen and fish buyers to consider the possibilities for cooperative relations rather than the typical coercive use of power currently characterising the first-hand sales of fish from the coastal fleet. Pie sharing efforts could lead to benefits exceeding those the parties would gain by acting as autonomous units (Jap, 1999). However, at the same time, both parties must carefully consider the commitments in relation to potential benefits that result from long-term exchange relationships.

Discussions should also take place regarding whether the regulation of first-hand sales could, to a greater extent, contribute to improved profitability for the coastal long liners in order to help prevent the declining trend of this fishery. If The Norwegian Fishermen's Sales Organisation introduced a similar price premium for line-caught cod, as is currently in place for haddock, it would improve the profitability of long lining. This would also relocate time-consuming and difficult discussions between fishermen and fish buyers from the pier to the negotiations between The Norwegian Fishermen's Sales Organisation and the fish buyers' association.

Different ways of organising the first-hand market may also enhance the quality of the fish. For example, Kristofersson and Rickertsen (2007), in their study of the Network of Icelandic Fish Auctions, found that gutting (gutted or un-gutted), fish size and storage time (and interactions of these characteristics) were the most important determinants of the price of cod sold through the auctions. This indicates that, through price incentives, auctions may stimulate fishermen to enhance the quality of their catches. It is worth pointing out that in 2005 and 2006 the The Norwegian Fishermen's Sales Organisation sat up three geographically limited auctions for fresh fish along the coast of Northern Norway. The conclusion was that the auctions led to an improved focus on fish quality, but also that strong ties between fishermen and fish buyers, as well as strong resistance from the fish buyers' organisations, made it difficult to continue after the trial period (The Norwegian Fishermen's Sales Organisation, 2007).

Organising the sale through vertical integration between fish buyers and fishermen also has the potential to improve fish quality, as the owner can dictate technology and handling practices (Porter, 1980). However, in accordance with Norwegian law, fish buyers are not permitted to have majority ownership in fishing vessels. Vertical integration between the coastal fleet and fish buyers is only possible if fishermen acquire fish buyers, but no such examples exist. However, as an exemption to this law, fish buyers in the filleting sector are permitted to own trawlers to ensure land-based production and employment in local communities all year round (Isaksen, 2007; Hermansen et al., 2012). However, the profitably of operating deep-sea trawlers implies very high utilisation of the catch capacity – and thus longer trips – which makes it difficult to provide high quality fresh fish (Finstad et al., 2012).

Direct government intervention through enhanced control of fish quality at the point of landing is also a possible remedy to improve fish quality. In fact, the Norwegian authorities –seemingly aware of the challenges described above – have recently (2012) modernised the current quality regulations and imposed upon The Norwegian Fishermen's Sales Organisation to enforce these regulations more effectively. It remains to be seen whether this will improve the quality of the fish from the coastal fleet. However, the very high number of transactions makes this a challenging task.

5. Conclusion

We conducted our research in one part of a value chain in a specific industry with a specific structure, specific sets of laws, regulations and institutions that have evolved over time (Holm, 1995). As the revealed thinking and behaviour of managers and fishermen unfold in the actual context, there is no reason to believe that other fishermen and managers in other fishing industries in other nations will think and behave in exactly the same manner.

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However, we believe that our theory-based analysis and discussion should also have value in other contexts where actors' attempts to maximise profits may well influence fish quality in similar ways to those shown here. Moreover, by demonstrating the crucial influence human thinking and behaviour may have on fish quality, our study may also inspire future research into the non-technical influences on fish quality, e.g. by studying whether and how macroeconomic and institutional conditions may affect fishermen and other actors' behaviour related to fish quality.

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