Handling and Holding Practices in the Production and Distribution of Fresh Fish and their Effect on Quality

March 1983 (Re-typed August 2005)

M. Myers

TR211

MAFF R&D Commission 1982/83

Working with the seafood industry to satisfy consumers, raise standards, improve efficiency and secure a sustainable future.

The Sea Fish Industry Authority (Seafish) was established by the Government in 1981 and is a Non Departmental Public Body (NDPB).

Seafish activities are directed at the entire UK seafood industry including the catching, processing, retailing and catering sectors.

Seafish Technology and Training: We promote the sustainable use of fish resources, quality, the reduction of waste and the improvement of safety through practical applied research.

We also develop standards, training programmes and learning support materials. We also promote training opportunities for all sectors of the sea fish industry through a national network of Group Training Associations. Quality award schemes are available for processors and friers.

Seafish Technical Report TR211

Author(s): M. Myers
Date: March 1983 (Re-typed August 2005)

Handling and Holding Practices in the Production and Distribution of Fresh Fish and Their Effect on Quality

Summary:

This report is the result of a study, sponsored within the 1982/83 MAFF research commission, of commercial practices of handling and holding fresh fish destined for human consumption, and the effect of those practices on quality.

The work was undertaken during the months December 1982 to March 1983 inclusive, and covers practices from the catcher right through to the consumer.

Particular emphasis is given to methods of temperature control in the processing and distribution chain, and the loss of quality resulting from poor control. Unannounced calls were made to shops or premises where purchases of fresh cod or haddock were made and the temperatures of fillets recorded. Utilising the facilities of the Advisory Inspection Service the fillets were then assessed for freshness using organoleptic methods.

The investigations showed unacceptably high fillet temperatures at retail outlets and disappointing overall standards of freshness. Even in winter months the results would suggest that about three days shelf-life is lost through poor practice, and that general levels of quality are lower than they need and ought to be.

The report comments on restraints to the introduction of improved practices or new technology, and makes recommendations for further work including ways in which improved practices or technology might be encouraged by education, financial inducement or regulation.

Table of Contents:

1. Introduction

Concern has long been expressed regarding the existing methods of handling and holding fresh fish in the U.K. in the chain from catcher to consumer. Compared to other sectors of the food industry, the methods and standards of operation of the fresh fish industry are often poor and inefficient. Whilst modern technology has brought about spectacular improvements in the quality and economics of protein food production in general, for numerous reasons there has not been a corresponding improvement in the production of fresh fish products. Even in areas where the technology is available to improve product standards it has often been ignored by a fragmented industry that is conservative by nature.

This report represents findings to date of investigations into factors affecting fresh fish quality and its improvement and is a project sponsored by a MAFF commission. The investigations, which are continuing, have been running since December 1982, although the report refers to previous work by the White Fish Authority and others. Within the context of the report quality is basically defined as the quality of eating, and is not so concerned with broader aspects of quality or factory quality control: it largely concerns freshness. The report is intended to provide a basis of information to assist policy decision making in matters relating to technical development and implementation, or to regulation.

Implicit in the desire to improve quality should be a knowledge of existing standards of product quality; but such is not the case. Although much work has been directed at specific projects concerned with quality aspects of stowage, discharge, processing, distribution, etc. by the W.F.A., Torry and the industry, little published data is available on the overall quality of product reaching the consumer, against which the significance of specific practices might be viewed. Indeed quality standards are not necessarily permanent, and may need to reflect changes in marketing or consumer requirements.

2. Objectives

2.1 To identify the distribution chain for fresh fish from quayside to consumer and to quantify the volumes where possible.

2.2 To define the practices of handling and holding in the chain.

2.3 To evaluate the effect of existing practices on product quality.

3. Description of the Supply and Distribution Chain

In any consideration of the supply and distribution of fresh fish due regard must be made to the basic nature of the source of supply and of the product. The patterns of supply into the chain are dictated by weather, season and fleet practices; and levels of fresh supply can seldom be assured. Once landed the highly perishable nature of fresh fish dictates that it be processed and distributed with as much speed as possible.

A fundamental problem for the industry is large variations in the daily landings at the port, with resulting fluctuations in auction prices. There is little vertical integration in the chain, and the diversity of interests involved does in itself present quality and marketing problems. At the retail level demand elasticity is low; partly as a consequence of mongers maintaining stable prices to the consumer and partly due to problems of promoting a product for which prices are not known in advance. Daily imbalances between port landings and consumer demand are therefore largely smoothed by delays in the processing and distribution chain (to the detriment of freshness quality). Freezing and cold storage of product can help in circumstances of glut but it is often uneconomic to invest in capital intensive plant to cater for peak landings.

A further problem concerning the speedy distribution in the chain is the lack of objective quality tests that can be applied commercially, which results in a high degree of selection and purchase by visual inspection. In many cases the display for inspection not only leads to delay but conflicts with requirements for good temperature control.

The sources of supply in relatively recent years have changed dramatically with huge increases in foreign imports following the decimation of the Humber-based distant water fleets. The quality of imported fish is, in many cases, reported to be superior to that which it replaces, probably due to shorter vessel trips and a greater degree of regulation and control by foreign government authorities with respect to methods of handling and holding.

Whilst the sources of supply have changed the distribution channels have not changed significantly, although the volumes passing through particular links in the chain may have diminished, causing financial problems of reduced revenue with fixed overheads.

The channels of distribution of fresh fish are complex, as shown in Figure 1, and although those indicated may not be exhaustive they include all significant routes. Precise volume figures for elements within the chain are often unavailable and are complicated by subsequent yield losses through processing. The values quoted in Figure 1 refer to landed equivalent weights (L.E.W.). A major route for landings to follow would be: auction - port processor/wholesaler - inland wholesaler - retailer - consumer, although a considerable volume also by-passes the inland wholesaler being delivered direct by the port merchants. Direct deliveries from the port are particularly common in the case of the frier, who requires only a limited range of products, and of the larger retailers who deal in sufficient volume to make it worth while (and who may deal with a number of port merchants). Based on current data where available, and interpretation of past

figures where it is not, it is estimated that the volume (L.E.W.) of fresh fish passing through the major wholesale markets of Billingsgate, Glasgow, Manchester, Liverpool, Birmingham, Belfast, Leeds, Bristol and Sheffield is in the region of 35 - 40% of all that reaches fresh retail level.

The physical distribution of fish is governed by port of landing, available processing capacity and locality of consumption, with major routes shown in Figure 2. More detailed study of the routing and carriers is covered by SFIA Interim Report on Survey of Distribution for Fresh Fish. Most fish is processed at or relatively near to the port of landing and then distributed, although there is a considerable volume of whole fish sent from the north-east of Scotland to the Humber-based processors which is shown as a dotted route in Figure 2.

Peterhead and Aberdeen alone provide over 25% of the total demersal landings in the U.K. from where they are distributed generally southwards.

3.1 Inspection of the Retail Trade

Retail trade of fresh fish may take place only in shops approved by the Ministry of Fisheries. The shops and the goods offered for sale are controlled by the fish inspectors and by the municipal health authorities. There is a trend to delegate inspection of the retail trade entirely to the municipal authorities in communities which have a developed veterinarian food inspection.

During recent years, fresh fish in sealed retail packages for sale in supermarkets has become very popular. Due to the fact that neither the seller nor the consumer are able to judge the quality of such a product at the time of sale, a special regulation issued by the Ministry of Fisheries lays down rules for the packaging and labelling of such products. The time of sale is limited to one or two days after packing, according to the species.

3.2 Processing

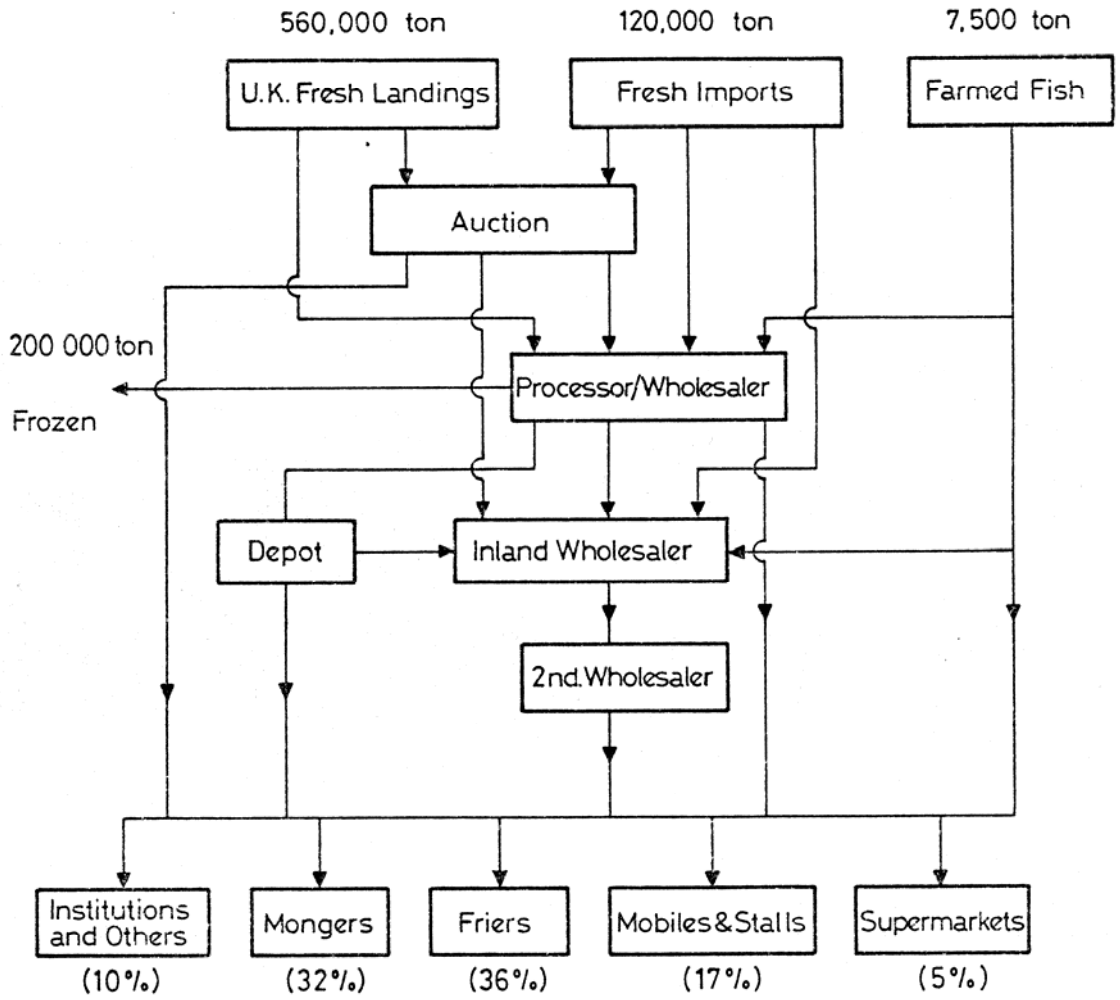
Processing of fish, including packaging of fresh fish in retail packages, filleting and freezing, may be executed only in plants authorised to do so by the Ministry of Fisheries on the recommendation of the Inspection Service for Fish Products. The local fish inspectors exercise control over the sanitation and production of such plants, but this control is supervised by the Inspection Service for Fish Products.

Samples of the final product are drawn at random. As far as fresh and frozen fish products are concerned, the freshness and quality of the product is in general assessed by the local fish inspector, but occasionally and in cases of doubt samples are examined at the laboratory of the Inspection Service for Fish Products in Copenhagen.

3.3 Quality Assessment

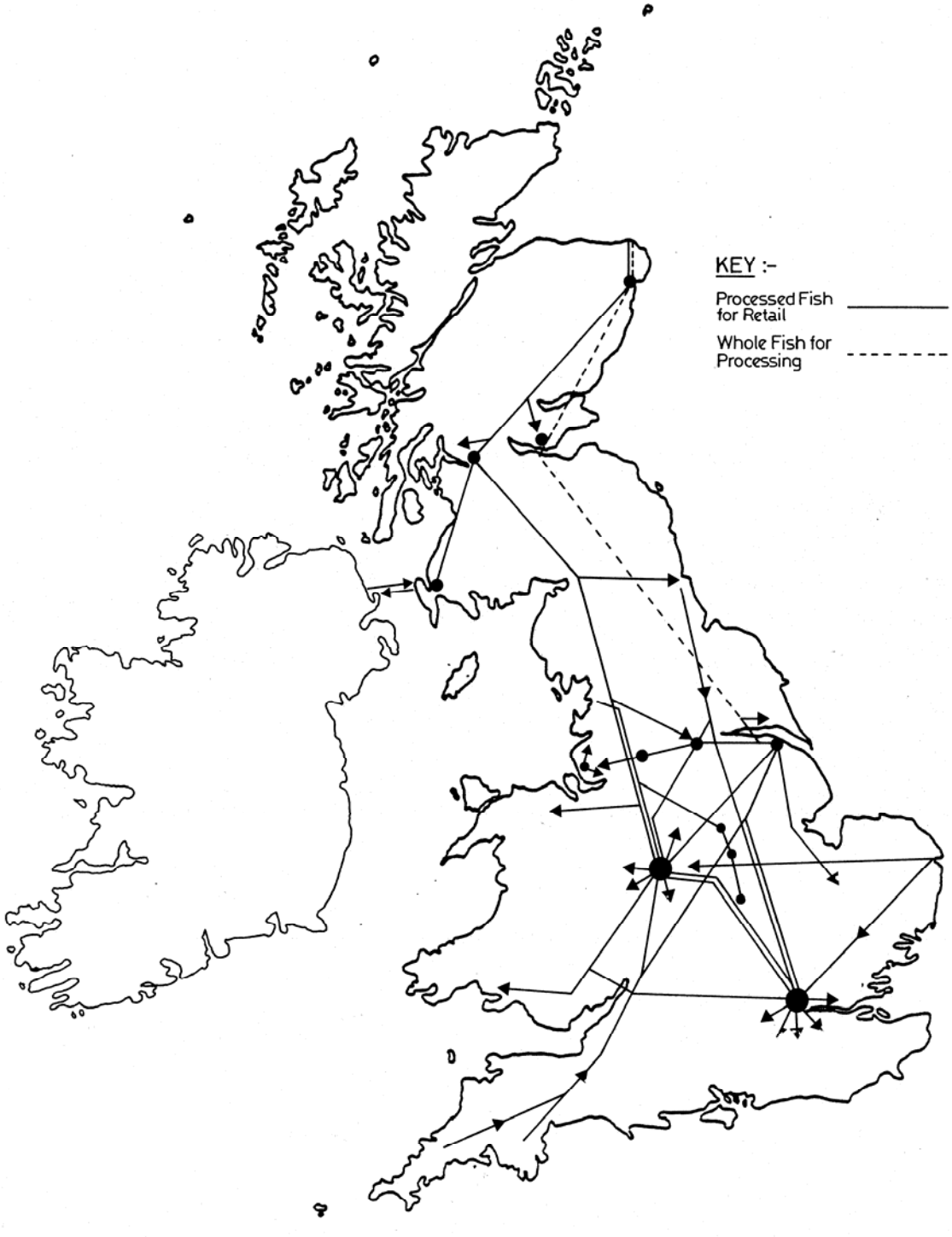
Only subjective methods are used for quality assessment in Danish fresh fish inspection. Guidelines for the fish inspectors' organoleptic testing of fresh fish are elaborated by the ministry of Fisheries (Jensen, 1960) but the practical

Fig.1.
Channels of Fresh Fish Distribution destined for human consumption



Figures in Landed Equivalent Weight.
1980

Fig. 2
Major Fresh Fish Distribution Routes in U.K.



experience gained from many years of daily work with fish has proved to be much better than any written guidelines.

At the laboratory, taste panels are used in addition to the direct organoleptic testing of the uncooked fish.

The reason why objective assessment methods are not employed is that such methods in general require too much time and furthermore have never been proven to be superior to organoleptic testing by experienced inspectors.

4. Practices within the Chain Affecting Quality

It was not possible within the time constraints of the project to quantify the effects of particular practices on the freshness quality of fish. The results of previous work in this area, notably by Torry and WFA staff have been incorporated into this project.

Investigation of the effect of specific practices within the chain is often confounded by the complexity of the chain. While a network exists that can process and distribute fresh fish from landing to the consumer from most ports within two days, it is often the case that variances in daily supply and problems of production scheduling result in much longer periods. Any given practice then that might be considered acceptable in a chain of time span two days might be totally unacceptable for an extended duration. The problem is that the effect of malpractices is cumulative in a chain that is at no point defined. Unfortunately the benefits of good practice are not always realised until later in the chain and in some cases this can be a restraint to their introduction. Often it is only when a practice can be seen to be of immediate commercial advantage is it implemented or enforced.

However efficient the land based operations of processing, distribution and retailing, the quality of fish upon landing cannot be improved by subsequent operations. It is clear therefore that trip lengths and vessel practices of bleeding, gutting, washing, handling, grading and stowage are of fundamental importance. Of the British fresh demersal catch 83% was landed (1981) by the inshore fleet, 15% by the middle-water fleet and less than 3% by the distant-water fleet. The relevance of the breakdown of landing by vessel class to quality is in the trip lengths that the vessels make and the practices that they employ. The inshore fleet is generally made up of small vessels, making trips of up to a week, that usually grade and box the fish at sea. The middle and distant water vessels are larger vessels making longer trips of up to eighteen days and usually bulk or shelve stow the catch. An analysis of the age of fish on landing by vessel classes in U.K. ports is given in Appendix 1. The inshore vessels that provide the bulk of the U.K. demersal supply should be able to land fresher fish to the quayside than that landed by the middle and distant water fleets by the very nature of the shorter trip lengths. They are however more likely to be affected by adverse weather conditions than the larger vessels which can result in greater fluctuations in daily landings. Large fluctuations in daily landings have to be smoothed out through the distribution chain so some loss of quality at the retail level is to be expected as a direct consequence. The fact is further compounded by fixed weekly patterns of sailing and landings by part of the inshore fleet. Generally vessel practices of gutting, washing, etc., are fair but with notable exceptions of landings of ungutted and uniced small haddock and codling during periods of heavy fishing in summer months and where demersal species are caught as a by-catch of the nephrop fishery when again they are often landed ungutted, uniced and also ungraded.

The practice of boxing at sea enables the catch to be discharged at the quayside in the box with the minimum of physical damage to the fish, particularly if the fish is graded at sea and auctioned in the same box. Discharge of bulked fish

requires digging out with shovels and pitch forks which even when undertaken with good intent can have ruinous effect on the fish. A particularly poor practice has evolved with boxing at some ports however where, in order to satisfy buyers that full weight is given, the box is over-filled with fish. over filling of boxes leads to crushing and physical damage of fish and freshness deterioration if, as a consequence, insufficient ice is used. The introduction of improved boxing at sea, and weighing at sea are current SFIA projects. If the fish is not graded at sea it is graded on landing, usually in the auction hall where it is then weighed into market boxes and laid out for display and sale. The sale is conducted at a fixed time, often in the early morning, usually in sequence of arrival of the vessels; the fish of the first vessel being auctioned first. The whole concept and process of sale by auction is problematic. There is no guarantee of sale at a price economic to catchers and delays caused by fixed auction times and methods of handling often have negative effect on quality. Market buildings are often antiquated and poorly designed for modern handling methods and hygiene. Temperature control is almost totally absent.

The distribution from the market hall to processor or wholesaler is by road transport except in those cases where the processor has premises actually on the market. Vehicles used depend on distances and volumes involved, with a mix of open flatbeds, covered, insulated and refrigerated lorries; with local delivery usually by open flatbed. In most instances the market kit or vessel box can be removed from the hall and used in the delivery, being later returned. Most market kits are the stack-nest type of high density polyetheylene which is tough, easy to clean and has a constant tare weight. rlany of the vessels however are still using wooden boxes which are unhygienic and less robust but of initial lower cost.

The techniques of processing and packaging are too numerous to enable detailed discussion here of implications of particular practices on quality. Good temperature control, methods of handling and hygiene are, however, crucial to all techniques whether the product be wet or smoked, fillet, steak or whole in distribution boxes or consumer packs. On reception the fish should be held on ice in chill until required for production and then processed, packed and chilled again maintaining adequate temperature control at all times. A particular problem of the manual filleting operation is the warming of fish in the water bath of the fillet bench in warm weather. On production lines it is important not to let produce accumulae at bottlenecks or to leave it on the lines during break times to warm. Once product has warmed through it is a problem to effectively chill it again particularly in the case of consumer packs (including Controlled Atmosphere Packaging).

Distribution from the port to inland wholesaler (or direct to retailers) is undertaken by road through a network of main trunker and secondary routes using insulated and/or refrigerated vehicles or Tautliners on the trunker routes and flatbeds on the secondary routes. Neither the Tautliner nor flatbed vehicles offer any temperature control other than that provided by the ice within the distribution boxes. The boxes which are nonreturnable are either of waxed card (in the majority) polystyrene, plastic or wood (for fish cakes), none of which is ideal. Wood is expensive and the waxed card and polystyrene and plastic have only limited physical strength. Polystyrene is particularly prone to damage by thin strapping that cuts into the box, and by crushing of the bottom box in a stack

under dynamic loads (particularly at the rear of the truck) although it does offer better thermal insulation. The fish boxes are individually loaded onto and off the vehicles manually with no use of pallets. Poor loading techniques sometimes contribute to damage by mixing of wet and dry loads and of polystyrene and wooden boxes. They are also sometimes loaded in poor order for delivery drops requiring drivers to climb over boxes for access. Delivery to the wholesaler or retailer is often made in the early hours of the morning (between midnight and five o'clock) to unattended premises, and in the majority of cases it is simply left in the yard or on the loading bay. The consignment is then often exposed to the weather, cats and dogs and liable to acts of theft. In some instances the driver has a key and delivers into the premises for reasons of security but very rarely can he ever deliver into chill.

Practices of the wholesaler or at the wholesale market vary. At Billingsgate for example, most fish is sold by sample, and as little as 25% actually passes into the market building. In practice the fish is sold from the car park and although the fabric of the building is new, the design and methods of handling are traditional. Chill stores are available to the merchants but are usually only used for holding fish overnight and not always then. Delivery from the wholesale market is usually the responsibility of the buyer.

Fish friers, who represent the single largest group buyers of wet fish, occupy a unique position in the trade selling a cooked product in competition with fast food chains. They are typified as husband and wife operators, and standards of hygiene and quality of product vary enormously reflecting trade skills and facilities of holding and production. One example can be quoted of a frier who stored his fillets in his front room in plastic dustbins.

The traditional wet fish monger is the second largest retailing sector, although in recent years it has been losing ground, largely to supermarkets and freezer centres selling frozen products. It is again typified by the owner operator (since the demise of the MacFishery chain in 1979/80) and practices and facilities again vary enormously. It is probable that the greatest rate of loss of freshness in the processing and distribution chain occurs at the monger shop, largely as a result of poor temperature control. From reception to sale insufficient consideration is given to keeping the fish at ice temperature. Indeed an insignificant number of mongers use ice in winter months and relatively few in summer. But even in winter the use of spot lights for illumination of display can give rise to unacceptably high fish temperatures. Less than 2% of the mongers visited in the quality survey had their own ice makers, and over 50% of the displays were non-refrigerated slabs. Comment should also be made of repeated holding-over of fish and the not infrequent practice of freezing unsold fish at the weekend and thawing again for display on Monday or Tuesday, particularly by the smaller merchants and merchant/grocer.

Although the market share of supermarkets is small in comparison with other sectors it is important because it is an expanding market of some potential, as illustrated by the growth at a single store from zero to a quarter of a million pound turnover in four years. Backed by the financial resources of the multiples they are usually better equipped in terms of display cabinets, ice makers and chill storage, etc., but in some cases lack the experience and trade skills of the traditional

monger. In an effort, partly to overcome the requirement for trade skills at retail level but equally for reasons of space utilisation and advantages of handling, pre-packaged chilled fish, particularly controlled atmosphere packs, are popular with some chains. Pre-packed chilled products often carry sell-by and consume-by date stamps for guidance which, while commendable in concept, can give rise to misplaced optimism regarding shelf-life based on the assumption of adequate temperature control in the chain that may not be achieved in practice. The preparation of codes of practice for handling and display of C.A.P. products is a current SFIA project.

Another expanding sector of the retail trade is that of the mobile retailer, which has grown rapidly in recent years. There are now thought to be over one thousand mobiles in operation throughout Britain, and they are typified by owner-operators although some mobiles are operated by high-street mongers, port-merchants or on franchise. Most obtain their supplies from port or wholesale merchants early in the morning and make deliveries during the day. Very few operators use purpose-designed vehicles although they are governed by Food Hygiene Regulations of 1966 that are enforced locally with varying degrees of tolerance. By order of the regulations the mobiles are to be of hygienic design and consruction, to be equipped with water supply and washing facilities, and to carry ice for good temperature control of fish. The mobiles are constantly criticised by high street mongers for setting low standards and for unfair competition. Regarding the former there are undoubtedly 'cowboy' operators with low standards (just as some mongers set low standards) but for the mobile operator to establish himself he must achieve repeat orders and this cannot be gained on poor quality fish badly presented. It is suspected however that too many of the operators are poorly equipped for basic processing, cleaning and storage of product overnight at their base of operation, which in some cases is the home. With experience, however, the roundsman can fairly accurately predict his volume of sales, which are less affected by bad weather, so that his carry-over will be small. Some operators have an arrangement with a local frier to take excess supplies for sale during the evening.

Fresh fish purchases are usually presented to the customer in a taped polythene bag or paper wrapping; the former having the advantage of greater protection aginst drip and contamination of other shopping purchases. Market survey by Gallup commissioned by SFIA (see Appendix 2) suggests that 30% of all purchases are kept in non-refrigerated storage prior to consumption although the period of storage is relatively short. Of the purchases held in refrigerated storage over 40% were held for periods greater than six hours and over 12% for over twenty-four hours. Limited survey of domestic refrigerators owned by SFIA staff members undertaken at the time of the study showed an average operating temperature of just under 3°C but with range of -3.5°C to +7.5°C.

5. Danish Practices

Other countries operate port wholesale auctions and are worthy of study and comparison; most noteably those of Denmark. Danish auction hall facilities are provided and maintained by the state and funded by a levy on fish landings, and are excellent. The buildings are modern portal-frame structures, fully enclosed and insulated and refrigerated at least in part at all ports. They are hygienic, well lit, well drained, spacious and equipped with good communication links. Most ports are run by a fishermans cooperative that manages a box pool, box washing (by machine), provisioning, bunkering, etc., and in some cases unloading labour. In each port there are usually two or three 'Samlecentrals' or grading companies which often operate 24 hours a day that receive the fish from the vessels (usually boxed) then grade, weigh and re-ice the fish ready for display on the market. If the landing is made during the day (after the auction) the fish is not left on the market floor but stored in chill and brought out for display just prior to the auction. Vessels wishing to land must usually register on the previous afternoon and be in port by 3 a.m. on the morning of the landing. When the vessel registers it is given a number, and a lottery then decides the order of sale for the landings of that day. Generally much greater regard is given to quality, and fish over three days old is often displayed separately on the market from that under three days old. Indeed some fish for local consumption is landed live, including cod and plaice, and is kept live through to the mongers shop where it is held in tanks and culled and processed to customer requirements by the monger. Thus headed, gutted and skinned fish can be served to the customer literally still wriggling.

Not only are the facilities provided within the ports superior in all respects to those in the U.K. they are backed up by regulation and control: of the fishery, of processing and of distribution, by the Danish Authorities, more comprehensive and more rigorously applied than in the U.K. Acts of Law cover practices of icing, eviscerating, washing, grading, packing and transport. The legislation gives the Authorities Inspectorate a framework of rights to inspect and control the practices of the industry with emphasis on high quality, having far wider powers than U.K. health inspectors who are concerned more with health risks than product quality. The inspection service has approximately one hundred field officers plus laboratory, technical, administration and legal back-up staff. Further details are given in Appendix 3.

6. The Significance of Temperature Control

From the moment fish are caught they start to spoil. The rate of the spoilage is dependent on temperature; the higher the temperature the faster the spoilage. White fish kept on ice near zero degrees centigrade will remain acceptable for about ten days. During that time the taste of the cooked fish progressively deteriorates from fresh sweet flavours to blandness. Thereafter sour then bitter and later putrid flavours develop. Deterioration of fish can thus be assessed organoleptically assigning a value or score to quantify freshness; the commonly accepted method of evaluation being the Torry Taste Panel System which is explained in Appendix 4. The Torry Score can be approximated to the number of days stored on ice.

After ten days on ice fish would typically score six and be bland tasting, having no sweetness but not yet exhibiting sour or off flavours. Scores of less than six have been shown by the SFIA/WFA Advisory Inspection Service to produce an unacceptablyhigh rejection rate. For fish kept at temperatures above that of melting ice the shelf life will be significantly less than ten days: fish held at 1000 for example will reach score six after only three days.

The significance of the foregoing can only be fully appreciated when viewed in relation to the quality and pattern of supplies into the chain. Vessels from some ports make trip lengths of up to 19 days, landing fish anything up to 17 days old, the oldest of which would already be sour. It is therefore obvious that in order to present a consistant high quality fresh product to the consumer, that methods of handling and holding throughout the chain be as efficient as is commercially viable.

7. Temperature and Quality Assessment

A most comprehensive survey of fish temperatures in the distribution chain was conducted by TRS in the summers of 1956 and 1957 during which nearly 30,000 recordings were taken at all stages of the land distribution, from unloading of vessel to sale at the retail shop. Since that time many changes have occurred within the industry, most significantly; to the make-up of the fleet, change from rail to road trunking, in retail practises, the use of new market and fillet containers in plastic, polystyrene and waxed card, and the introduction of controlled atmosphere packaging.

Unfortunately, many of the observations and criticisms made by the report of inadequate temperature control in the chain would appear to be as relevant today as they were over a quarter of a century ago.

Although it was not possible to emulate the scale of work undertaken by TRS it was possible during the months of December to March, using the facilities of the Advisory Inspection Service to conduct temperature and quality assessment work at retail and wholesale outlets. At retail level the study concentrated on mongers, but opportunity was also taken to visit friers and supermarkets and to obtain samples from mobiles if they were encountered. Unannounced calls were made to shops or premises where purchases of frswh cod and haddock were made. Upon purchase the temperature of the fish was reorded and then later the fish was assessed for freshness at the AIS mobile laboratory using the Torry Taste Panel System. Three trained and experienced panel members were employed in the assessment. Regions visited included Oxford, East Anglia, Kent, Manchester and Mersey with most visits being made in the morning or early afternoon. A summary of the results is shown in Table 1 which also includes the results of visits to wholesale merchants in the same regions.

Table 1

	Samples	Temp Range	Ave Temp	Torry Score Range	Ave Torry Score
Retail Outlets					
Mongers	166	0.5-20.5	6.9	4.0-8.2	6.6
Friers	30	1.5-9.5	5.1	6.0-7.5	6.5
Mobiles	6	2.0-5.5	3.9	6.0-7.5	6.8
Supermarket					
- WetBars	13	3.0-10.0	6.2	5.5-7.3	6.4
-Pre-Packs	14	4.5-8.0	6.1	5.8-7.0	6.4
Total Retail Samples	229	0.5-20.5	6.5	4.0-8.2	6.5
Wholesale Outlets					
Inland Merchants	38	0.5-7.5	2.6	7.0-8.2	7.5

(Temperatures in degrees Centigrade)

Ambient Temperatures ranged from 0°-10°C at the time of sample collection.

Although the total sample numbers preclude any firm conclusions on the general levels of freshness quality it does give cause for some concern considering the time of the year and the low ambient temperatures in which the work was conducted. Certainly average scores in the order of 6.5 are disappointing and suggest that when account is made of delays, and temperatures of holding, between purchase and consumption a significant percentage will be below the acceptable score of six. The highest and lowest qualities of fish and recorded fish temperatures were encountered at the mongers. Not shown in the table however are some fairly large local variations in both quality and fish temperatures. Samples taken from six mongers housed in a northern city retail shopping centre, for example, averaged over 15°C. It is quite possible that a correlation exists, between assessed quality and recorded temperature of fillet but it has not been examined as freshness quality is dependent upon total temperature history and not sampled temperature.

8. Discussion

Average freshness scores in the order of 6.5, or the equivalent of nearly ten days on ice, are disappointing in winter months when better scores might have been expected. Over 80% of landings are by inshore vessels with average age of catch three or four days. If an allowance of two to three days is made for processing and distribution then scores in the order of eight are possible at retail level, but during the study only five samples in two hundred and fifty eight achieved a score of eight. In practice the inability to maintain fish or fillets at ice temperature at all times, and the necessity to smooth supplies would result in average scores of less than eight but certainly scores of 7-8 should have been more common at retail level. In effect three days shelf-life is lost by inefficient handling and holding practices in the production and distribution chain. It can only be speculated what the overall quality levels and loss of shelf-life would be during hot summer weather given the existing methods of handling and holding described in Section 4. Very little data has ever been published on the quality of fish at retail outlets.

The practices and technology necessary to maximise quality and shelf life are known, it is their application that is lacking, and it is lacking throughout the chain. Significant factors in the lack of investment for purposes of quality improvement are the fragmented nature of the industry and the difficulty of accurately applying objective quality tests commercially. There is an obvious reluctance to invest unless the investment can be seen to improve quality and thereby be rewarded financially. Often the benefits of investment, or results of the lack of it, are realised later in the chain and are remote. Another factor is the limited power of the retailers to influence practices in the chain that determine quality. Traditionally mongers and friers are family businesses; their individual trade with a wholesaler or port merchant is small and their influence correspondingly so. The fairly recent growth of retailing fresh fish through supermarket chains affords the opportunity, either through central buying or by collective standards and specifications, to impose quality standards and acceptable practices by virtue of their value to the wholesaler or port merchant. Supermarkets require a consistancy of product and supply at an agreed price; difficult demands given the perishability of fresh fish and the nature and structure of the industry. But given the above, fresh fish of guaranteed quality can be promoted in similar fashion to other products. As an example a south-coast supermarket visited sold four and a half thousand pounds (weight) of fresh trout in one week by advertising a prior arrangement with a local fish farm.

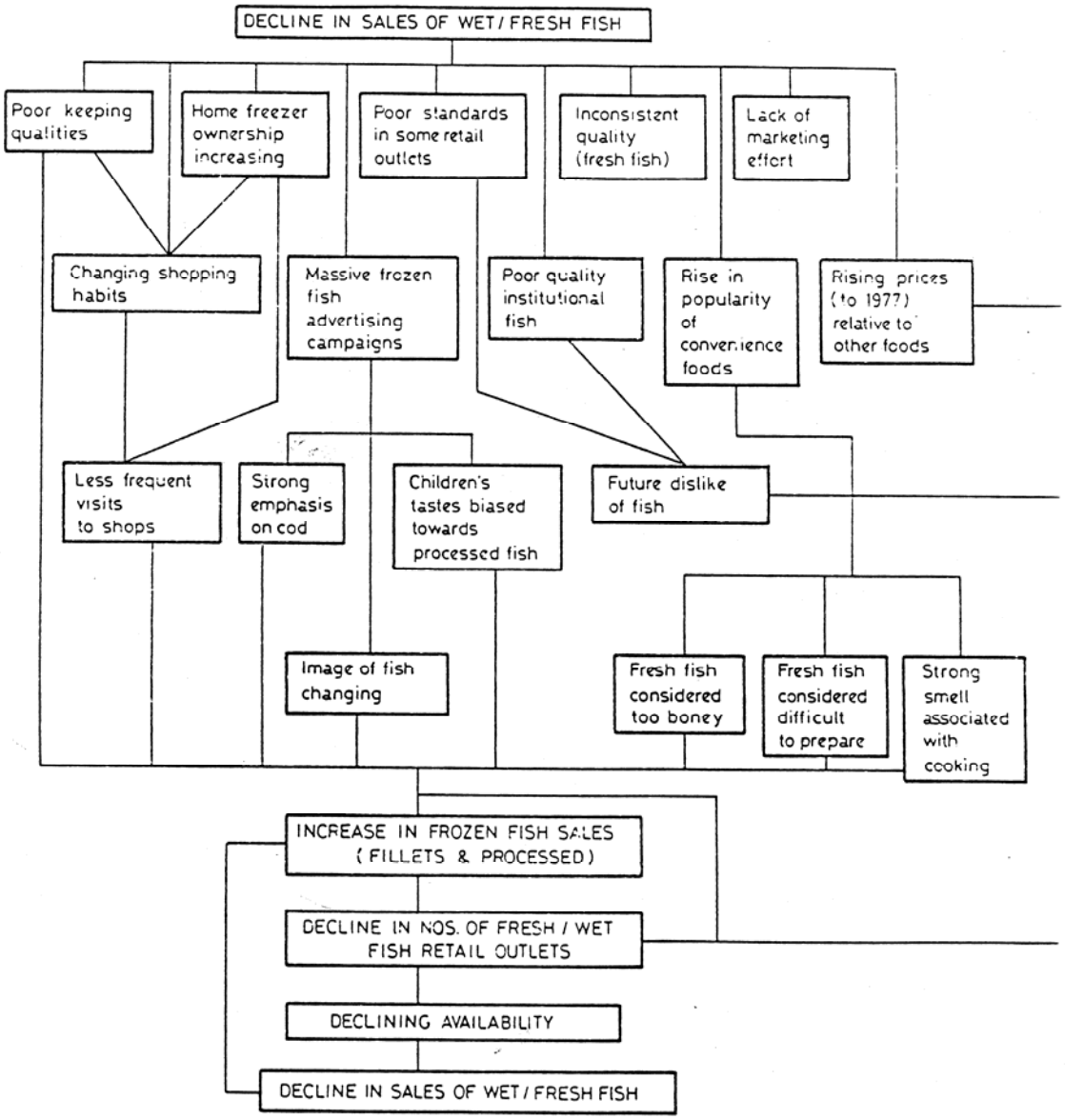
The traditional fish monger also requires consistency of product and supply but has lived with auction price fluctuations in the past by maintaining a fixed level of retail prices such that the margin when prices at auction are low compensates for periods when auction prices are high. Fishermen argue that retail prices should be lowered in glut conditions when wholesale prices are low to increase volume of sales. Mongers argue that the customer prefers stable prices and that they would not understand or appreciate marked fluctuations in prices. Furthermore they argue that low spot prices, caused by glut conditions may not attract a significant increase in volume of sales. A customer entering the mongers shop does so with the intention of purchasing fresh fish; there is little impulse buying.

The same might not be true of the supermarket. To attract custom to the mongers shop (which is not always well located for passing trade) when fish is cheap, promotion is required. A problem with promoting fresh fish however is the lack of advance knowledge of prices. One of the most effective forms of advertising, the local newspaper, of a few days which is not possible with system. The crux of the problem is the absence of a realistic relationship between market auction and retail prices.

Cartwright in ‘An examination of the decline in Fresh Fish Sales with special refernce to the Traditoinal Fish Monger’ (1982) mentoins lack of marketing effort and inconsistent quality as contributing factors in the decline. Figure 3 gives his diagramatic representation of factors affecting the decline of sales.

By-passing the wholesale market by contract fishing has many attractions, including quality improvements achievable by reduced delay and handling and better temperature control. However, it has been attempted numerous times in the past with liited lasting success, and only a few boats now work on a contract basis for processors.

Fig. 3
Decline in the Fresh Fish Trade – A Diagrammatic Representation



Source – 'An Examination of the Decline in Fresh Fish Sales with special reference to Traditional Fishmongers' I. Cartwright 1982.

9. Conclusions

9.1 There remains a lack of data on the levels of quality at retail outlets of all types but from the limited assessment undertaken during the study there are grounds for concern at the low levels seen.

9.2 There remains a lack of evidence of the effect of specific practices of handling and holding on quality.

9.3 The limited evaluation of quality at retail outlets undertaken during the winter months by this study would suggest that about three days shelf-life is lost through poor practice and that the general level of quality is lower than it need and ought to be. In fact there is evidence to suggest that upon consumption a significant if not large percentage of fresh fish would be close to the level at which it would be likely to be rejected, and the problem is expected to be worse in the summer months.

9.4 Loss of freshness, caused by poor temperature control, occurs throughout the chain, from dockside to retailer, but the greatest rate of loss would appear to occur at the mongers.

9.5 Loss of freshness is also a consequence of landing patterns by vessels that take no account of the processors and retailers requirements.

9.6 The practices and technology to improve qulaity are laregly available; it is their application that is lacking.

9.7 The greatest restraints to the application of technology for improved handling and holding are; the fragmented nature of the industry and the difficulty to accurately apply quality tests commercially. Financial restraints are more a consequence of these factors than necessarily a primary cause.

9.8 Supermarkets although usually well equipped, in some instances, lack the traditional fishmongers skills and experience.

10. Recommendations

10.1 Studies should be made of quality and temperature control at retail outlets in summer months in warmer weather when quality is more likely to suffer as a consequence of poor practice.

10.2 Further study of identified poor practice is required to determine the effect of quality.

10.3 Improved or alternative methods of handling, holding and packaging need to be investigated and evaluated on a quality/cost basis and tested commercially.

10.4 Consideration should be given to ways in which improved practices might be encouraged within industry by means of education, financial inducement or regulation. Codes of practice are important as a guide but must be accepted to be of any benefit. Specific suggestions are:

Education in Supermarkets
Training of staff in fishmongering skills.
Advice and assistance in preparation of conditions and specifications for purchase, backed up by inspection service of supplies.

Technical and Financial Assistance
Mongers:
Refrigerated display cabinets of approved
Ice making machines

Mobile Traders:
Purpose built and equipped vehicles.
Depot or base facilities (garages are not suitable for storage or preparation of fish for sale).

Regulation
Mobile Traders:
There should be a central registry of mobile fish traders.

Appendices

Appendix I

Analysis of Trip Lengths and Age of Fish on Landing

Analysis of Trip Lengths and Age of Fish on Landing

Port	Type of Fishing	Stowage	Trip Length (Days)	Min/Max Age on Landing
Grimsby	Danish seining	Bulked	13-19	1-17
	Pair trawling			
	-winter	Bulked or	10-14	2-12
	-summer	Boxed	4-6	0.5-5
	Gill netting	Shelved	4-6	1-4.5
	Middle waer Trawlers	Bulked	10-18	1.5-16
Peterhead	Fly dragging			
	40' – 60'	Box	1-2	0.5-1
	80'	Box	4-7	1.5-5.5
	Pair Trwlers	Box	4-8	1-7
Aberdeen	Middle Water Trawlers 100'+	Bulked	10-12	1.5-9
	Near Water Trawlers	Box or Bulked	4-8	1-6
	Fly dragging			
	- large	Box	6-8	1-6
	- small and Inshore trawl	Box	1-4	0.5-3
	Great line	Bulked	12-17	2.5-12.5
Lowestoft	Middle Water Trawling	Part Box		
	Beam Trawlers	Bulk	12-14	2-12
	Small Lines	Box	2-8	0.5-6
		Box	1-2	0.5-1
Bridlington	Inshore Trawling	Box	1-2	0.5-1.5
Scarborough + Whitby	Inshore Trawling	Box	1	0.5
	+Fly dragging	Box	2-4 (summer)	0.5-3
Eyemouth	Inshore Trawling + Fly dragging	Box	1-4	0.5-3.5
Buckie	Inshore Trawling + Fly dragging	Box	1-2	0.5-1.5
Kinlochbervie + Lochinver	Inshore Trawling + Fly dragging	Box	1-2	0.5-1.5
Milford Haven	Neatr Water Trawling	Bulked	8-12	1-11
Fleetwood	Middle Water Trawlers	Bulked	8-12	1-10
	Near Water Trawlers and Inshore	Box	1-4	0.5-3
Newlyn Brixham Portsmouth	Beam Trawlers	Box	2-5	0.5-4

Port	Type of Fishing	Stowage	Trip Length (Days)	Min/Max Age on Landing
Above plus other inshore ports	Inshore gill Trammel nets and trawlers	Box	1	0.5
Newlyn	Great liners	Box	4-8	1-6
North Shields	Fly draggers - large - small Inshore trawl	 Box Box Box	 4-10 1-2 1-2	 0.5-8 0.5-1 0.5-1
Fraserburgh	Inshore trawl And Fly draggers	Box	1-4	0.5-3.5
Co. Down N. Ireland	Pelagic (white fish) boats 80’ Demersal Trawl 50’-60’	Box Box	2-3 1	0.5-2 0.5

Appendix II

Customer Practice

Customer Practice

Based on Omnibus Survey by Gallup Poll Ltd. February 1983. Total sample of 891 persons of which 585 purchased fresh fish.

1. How long after you have bought fresh fish do you usually keep it in the home? Is that in a refrigerator or not?

	% Refrigerated	% Unrefrigerated
Under 6 hrs	40	27
6 – 12 hrs	12	1
12 – 24 hrs	8	1
24 hrs plus	9	0
Varies	2	2

2. Why do you not keep your fish in a refrigerator?

	%
No refrigerator	5
Tainting of other food	11
Not necessary	40
Cooked and eaten straight away after buying	33
Other reason	3
Do not know	11

3. How long after you have bought fish is it before you get your fish home?

	%
Less than 1 hr	38
1 – 3 hrs	9
3 – 6 hrs	0
Over 6 hrs	0
Varies	52

Appendix III
Fresh Fish Inspection in Denmark

Fresh Fish Inspection in Denmark

By Paul FR. Jensen, Director of Fish Inspection Service

Inspection Services

The geographic position of Denmark in relation to her fishing grounds and the European markets, has formed the basis for the traditional Danish fresh fish trade. To support this trade an inspection service was inaugurated in 1888, originally to protect the fisheries, but, as the international trade increased, also to inspect the freshness and quality of the fish. About 30 years ago because of expanding industrial development this well established fresh fish inspection service was supplemented to provide processing plant inspection. This type of inspection has developed as necessary to keep up with technical progress in the industry. This explains why fish inspection in Denmark today is administered by two different, but closely collaborating bodies, the Fisheries Inspection Service and the Inspection Service for Fish Products (Jensen, 1961).

Fisheries Inspection Service

Denmark is divided into 34 fisheries inspection districts, and there is a fisheries inspection station in all important fishing ports and export outlets. The fish inspectors are given practical training and have a particularly good knowledge of fishing and of fresh fish. New recruits are usually young fishermen.

Inspection Service for Fish Products

This service is a centralised body located in Copenhagen. Technically trained personnel (with university degrees) and a laboratory are at its disposal.

Legislation

For the purpose of maintaining and further raising the quality of Danish fish, a law on quality control of fish and fish products was passed in 1950 and has been revised twice. The present law passed in 1965 contains some basic provisions and empowers the Minister of Fisheries to issue more detailed regulations. This has been done with regard to the treatment of fresh fish on board and on shore.

The most important provision deals with icing. During summertime (May - September), all fish which are not landed alive must be iced immediately after being caught, and during wintertime (October - April) within eight hours. The icing must be maintained through the trade chain, not only to protect the fish against heat, but also against desiccation and partial freezing. Other provisions cover eviscerating, washing and sorting of the fish.

The law establishes that decisions made by the inspection services are final as far as fresh fish is concerned. Decisions on canned, frozen or otherwise preserved fish may, however, be brought before the Committee for Complaints set up by the Ministry of Fisheries.

Inspection Practice

Inspection at Landing

The characteristic features of the Danish fisheries and fish trade, small vessels with no processing on board and sale through auctions, provides an excellent opportunity to perform the inspection of fresh fish at the time of landing.

Fresh fish inspection is the main task of the inspectors of the Fisheries Inspection Service. These inspectors, numbering about 100, are on the spot where the fish are landed. When the fish are taken from the hold of the fishing vessels and displayed in boxes in the fish auction hall, the inspectors check the sorting, cleaning and icing, and determine that the fish are of good quality. At the large fishing ports thousands of boxes are piled in the auction hall, but the experienced inspector is able to judge the fish quickly and accurately.

If the sorting or grading is not satisfactory, the inspector can request that a re-sorting or re-grading be done. Fish which are unfit for human consumption are condemned by the inspector and may only be used in reduction plants or for animal feed. Condemened fish are marked with a red label, and furthermore a red colour (Ponoeau 4 R, C.I. 1956 No. 16255) is poured over the fish.

Fish which are still fit for human consumption but which are defective may be used only in accordance with instructions given by the fish inspector. A green label attached to the fish explains this. For instance, a tuna with some bad cuts must not be exported fresh or frozen, but may be utilised in a cannery where the defective parts can be cut away and discarded.

Packing and Distribution of Fresh Fish

Fresh fish only may be packed for distribution - whether for the domestic market or for export - in premises which are approved for this purpose by the Ministry of Fisheries. The sanitation of the premises is controlled by the fish inspectors who ensure that the fish when shipped are of good quality and packed with an adequate amount of ice.

A final check of export goods and a refilling of ice may take place at the frontier station. An inspection certificate (certificate of health) is issued by the inspector on request by the exporter.

The only wholesale fresh fish market in Denmark is located in Copenhagen. The inspection at this market is very similar to that at the fish auctions. Fish inspectors are present when the fish arrive from all over the country, and the quality of the fish is determined before sales begin.

Appendix IV

Torry Taste Panel Sysem for Assessing Freshness

Torry Taste Panel System for Assessing Freshness

Preparation of Sample: Fish to be tested must be steamed in a closed dish over boiling water for 35 minutes or if frozen for 18 minutes after thawing. The dish should remain covered and be kept in a water bath of 60 deg. C. during testing.

Scoring System, Cod, Haddock, Whiting, Coley, South Atlantic Hake

Fresh, sweet flavours characeristc of the species	10
Some loss of sweetness	9
Slight sweetness and loss of the flavour characteristic of the species	8
Neutral flavour, definite loss of flavour but no "off" flavours	7
Neutral flavour, definite loss of flavour but no "off" flavours	6
Absolutely no flavour, as if chewing cotton wool	5
Trace of "off" flavours, some sourness but no bitterness	4
Some "off" flavours and some bitterness	3
Strong bitter flavours, rubber-like flavour, slight sulphide-like flavours	2
Strong bitterness but not nauseating	1
Strong "off" flavours of sulphides, putrid, tasted with difficulty	0

Scoring System, Redfish

Very sweet or intense sweetness, characteristic flavour	10
Definitely sweet, nutty (Brazil), meaty	9
Loss of sweetness, nutty (Brazil)	8
Very slight sweetness, neutral, milky, chestnut, slight off nut-oil	7
No sweetness, no sourness, tasteless, cotton wool	6
"Off" flavours, bad nuts, herring, some sourness, slight rancidity	5
Strong "off" flavours, strong sourness, some bitterness, rancid oil	4
Strong bitterness, biting rancidity, sulphide flavours	3
Nauseating flavours, difficult to hold in the mouth	2
Nauseating, putrid	1

Scoring System, Plaice

Meaty, shellfishy, earthy	9
Sweet, and meaty, (or oily fresh herring-like)	8
Sweet, meaty with curry, peppery or spice flavour	7
Neutral or bland	6
Rancid, slightly sour	5
Sour and bitter	4
Strong sour and strong bitter, rotten fruit	3
Nauseating	1

Scoring System, Herring (Flavour of Brown and White Flesh)

Fresh, sweet, seaweedy flavour	1
Less sweet, seaweedy flavour, plus slight oily flavour	2
Stronger oily flavour; some stale seaweedy flavour and some "blown oil" flavour	3
Definite "blown oil" flavour, plus stale, seaweedy flavour	4
Definite unpleasant "blown oil", "sweaty" or rancid flavour, definitely stale	5
Repulsive flavour	6

